The Electrical Industry's Weekly Magazine

November 10, 1958

Electrical World

Price 50 Cents

A McGraw-Hill Publication

Old Moscow Church

Hydro Dam—Kuibyshev

Soviet Transmission Tower

Russian Welcome for Cisler

Russian Women Workers

EEI Reports on USSR Power Picture

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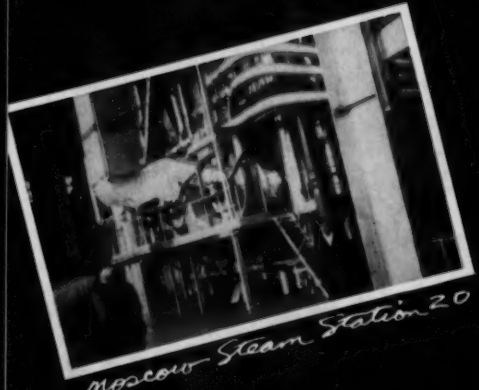
USSR Substation



Moscow Steam Station 20

STEVENS RICE
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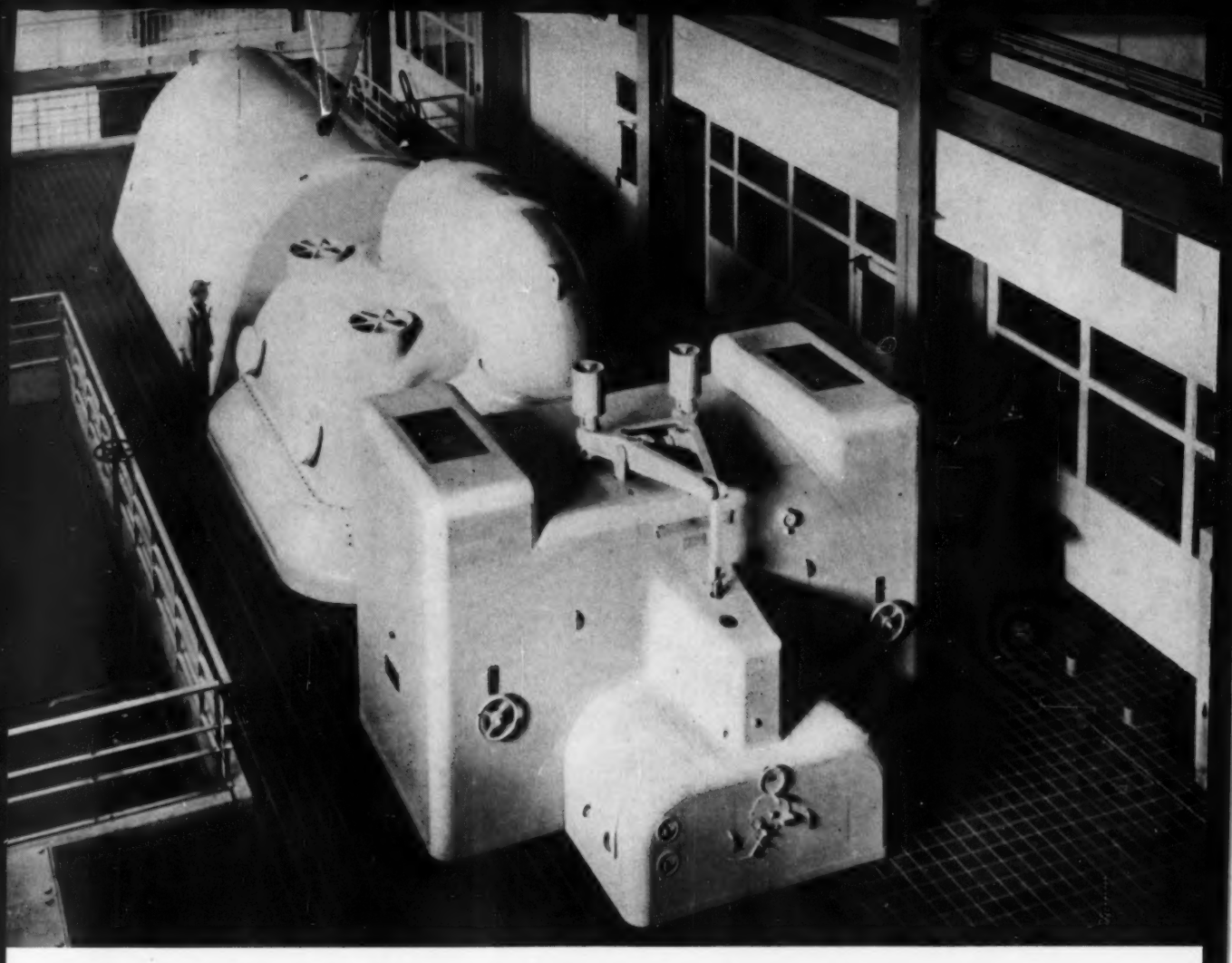

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There's extra service built into Texaco Regal Oil R&O because it gives dependable protection against rust and oxidation as it lubricates. It's a first rate lubricant fortified with extra resistance to the formation of rust, sludge and foam.

The additives in Texaco Regal Oil R&O keep systems clean. The oil circulates freely throughout an extra-long service life. The bearings stay cool and the governor runs steadily and dependably.

There is a complete line of Texaco Regal Oils R&O to give long-term protection to any type or size of turbine. A Texaco Lubrication Engineer will be glad to help you select the right oil for your equipment. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

Electrical World

Vol. 150, No. 19 NOVEMBER 10, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

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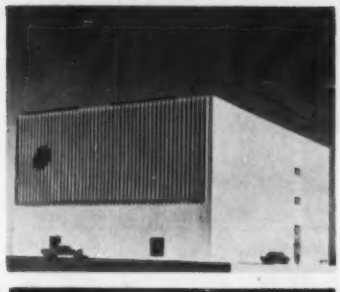

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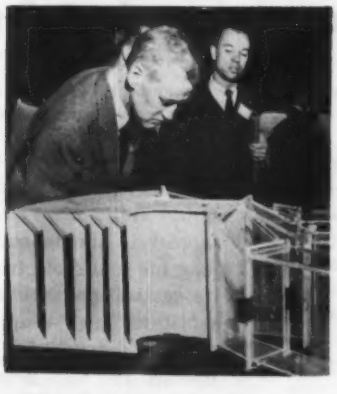

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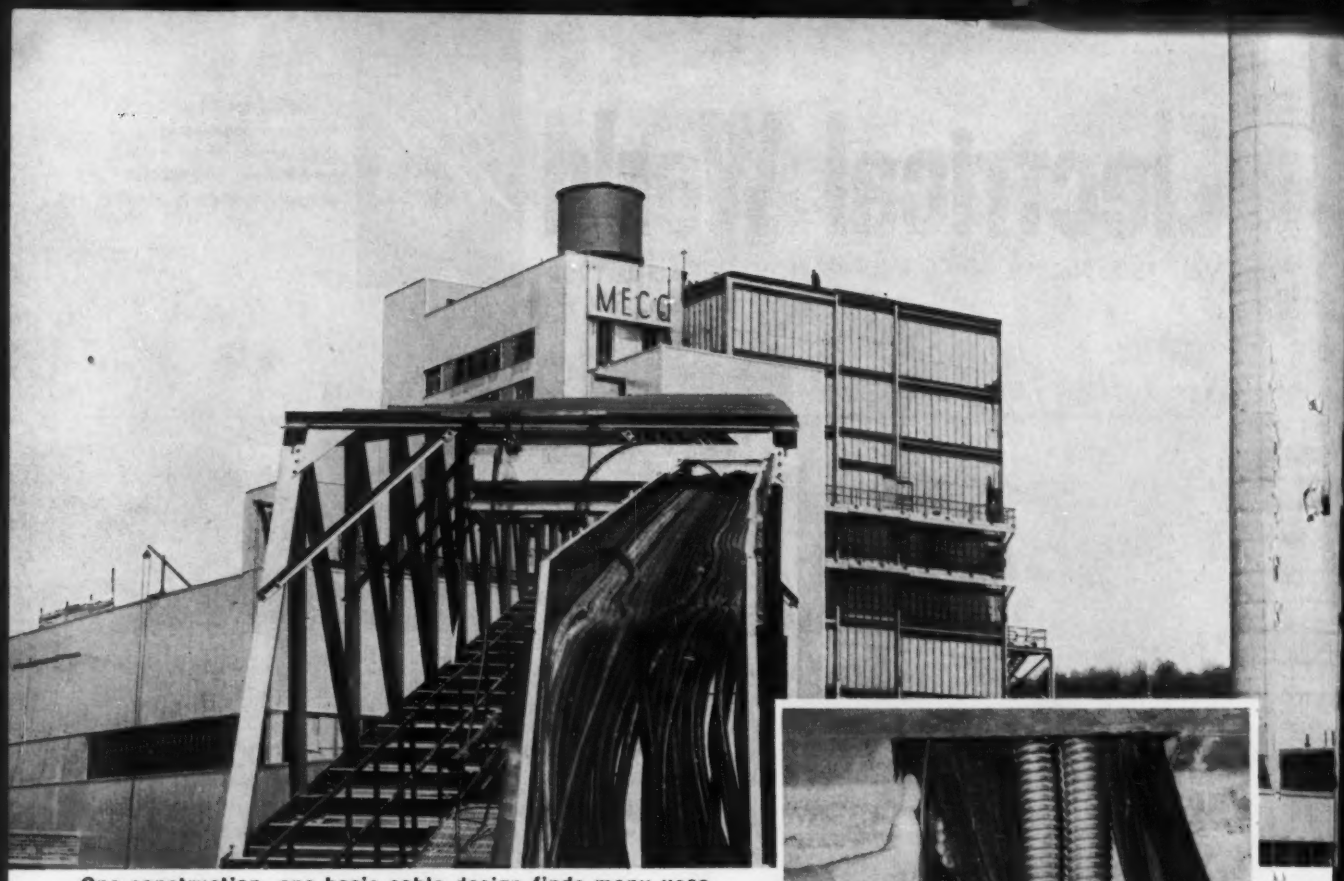

One construction, one basic cable design finds many uses. Open coal conveyor structure shown under construction above carries Okolite-Okoprene power and control cables from Metropolitan Edison Company's new Portland Generating Station to coal storage yard. Three types of the same cable meet in the tunnel (right) beneath the switching station: Okolite-Okoprene with CM-OT finish; Okolite-Okoprene with aluminum Loxarmor; Okolite-Okoprene with straight Okoprene sheath.

Another leading utility picks
Okolite-Okoprene for maximum margin of safety

Utmost reliability, proved by long-term service records, is the reason why Okolite-Okoprene was selected for the brand new Portland, Pa., Generating Station of the Metropolitan Edison Company—engineered by Gilbert Associates, Inc. Various Okolite-Okoprene cables have been installed for 600-volt power and control service with protective coverings designed for specific installation conditions. For example:

- **To avoid expense of conduit...permit quick addition of new circuits**...Okolite-Okoprene power cable with flexible aluminum Loxarmor, in trays, carries power to motors, pumps, coal conveyors, fans and practically all other operating equipment.

- **For maximum protection against soil corrosion, mechanical damage and insect attack**...Okolite-Okoprene control cable with Type CM-OT (corrugated bronze tape) finish is used for direct burial underground circuits to the switching station in the yard. Finish combines remarkable compressive strength with light weight and easy handling.

- **For great weathering strength and resistance to abrasion**... Okolite-Okoprene control cable with an overall Okoprene sheath is used for most other control circuits within station ...and installed in outdoor trays leading to coal storage yard.

Power stations from coast to coast rely on Okolite-Okoprene for vital power and control circuits—a testimonial to its dependability . . . its long life and dielectric strength . . . its resistance to corona cutting, moisture, heat, chemicals and mechanical damage. For further information on this premium quality cable, made by Okonite's exclusive strip-insulating process . . . and its adaptability to your important circuits, write for Bulletin EW-1085, The Okonite Company, Passaic, New Jersey.

where there's electrical power... there's **OKONITE CABLE**

6358

Deadline Is Near on Gas Cooled Reactor

On September 22, 1958, the Atomic Energy Commission issued an invitation to individual organizations, or groups of organizations representing privately, publicly, or cooperatively owned electric utilities, and to equipment manufacturers, and others to submit proposals for construction of a gas cooled, graphite moderated nuclear power plant.

The ultimate cost of this power plant is estimated to be in the range of $51 million but it is assumed that the government will underwrite a reasonable share of the cost.

We understand that a number of power companies have pledged support for a proposal to be submitted by private industry.

This is an urgent need and a worthy cause. The deadline of November 21 is drawing near.

The previous support of the private power atomic program has been excellent. And there are great needs ahead which will surely receive similar backing.

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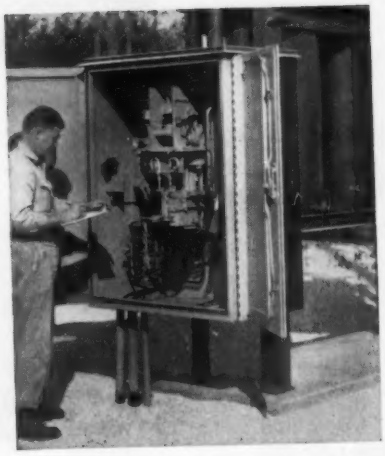
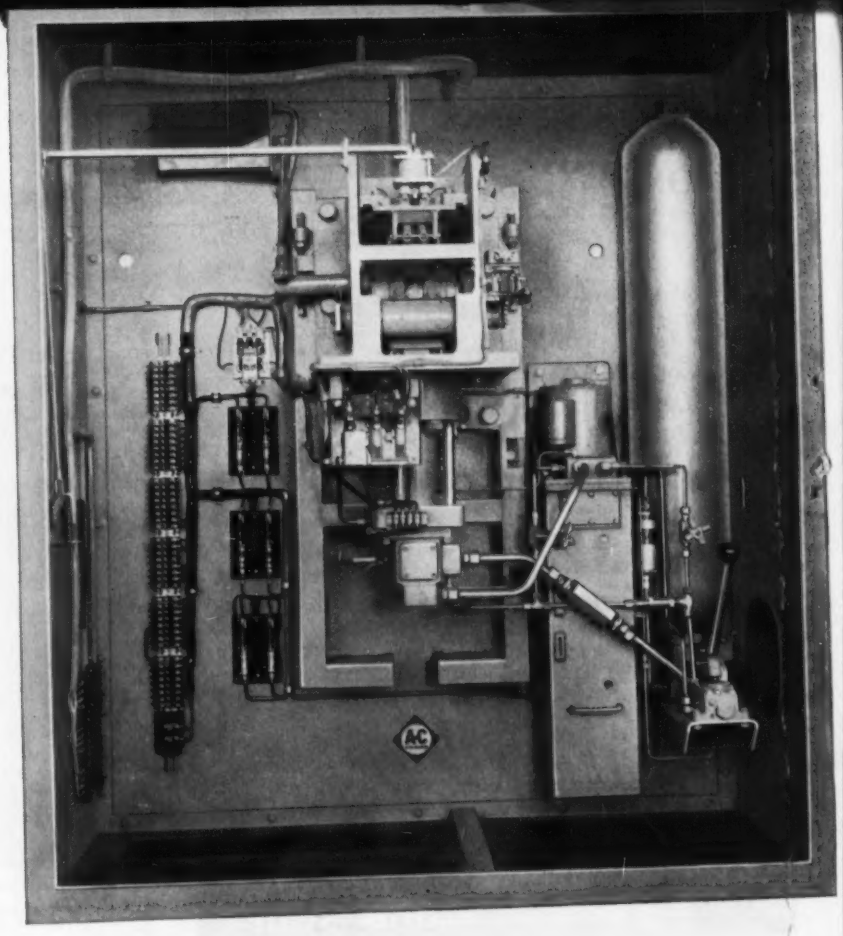
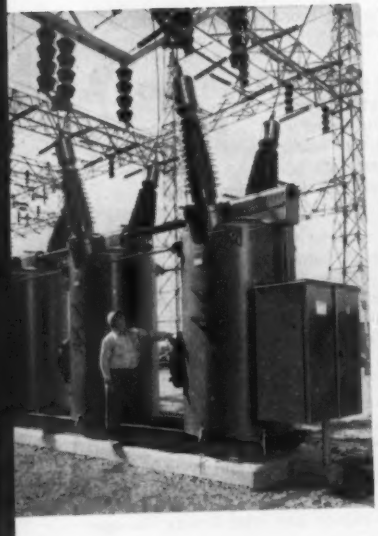
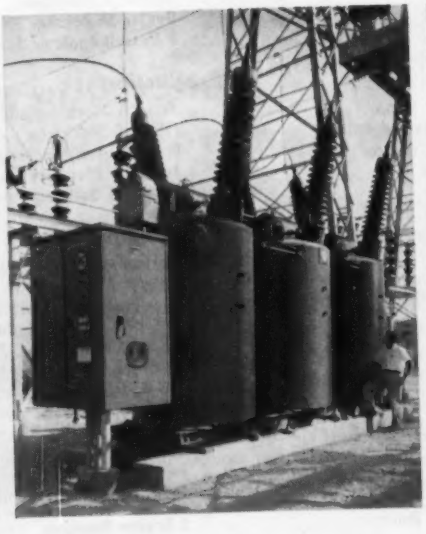
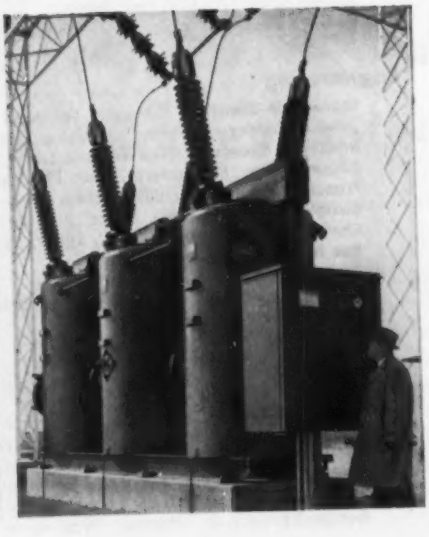










A-5812

ALLIS-

Plan to stay ahead... MODERNIZE!

NOW... on 90 power systems

...Allis-Chalmers breakers with *Pneu-Draulic* operators

Here's proof of user confidence in a product which was a revolutionary innovation 40 months ago. Over 60% of these companies have placed repeat orders. They have discovered for themselves the combination of simplicity and reliability inherent in *Pneu-Draulic* operators.

Pneu-Draulic operators are available on all Allis-Chalmers outdoor breakers rated 14.4 kv, 500 mva and larger.

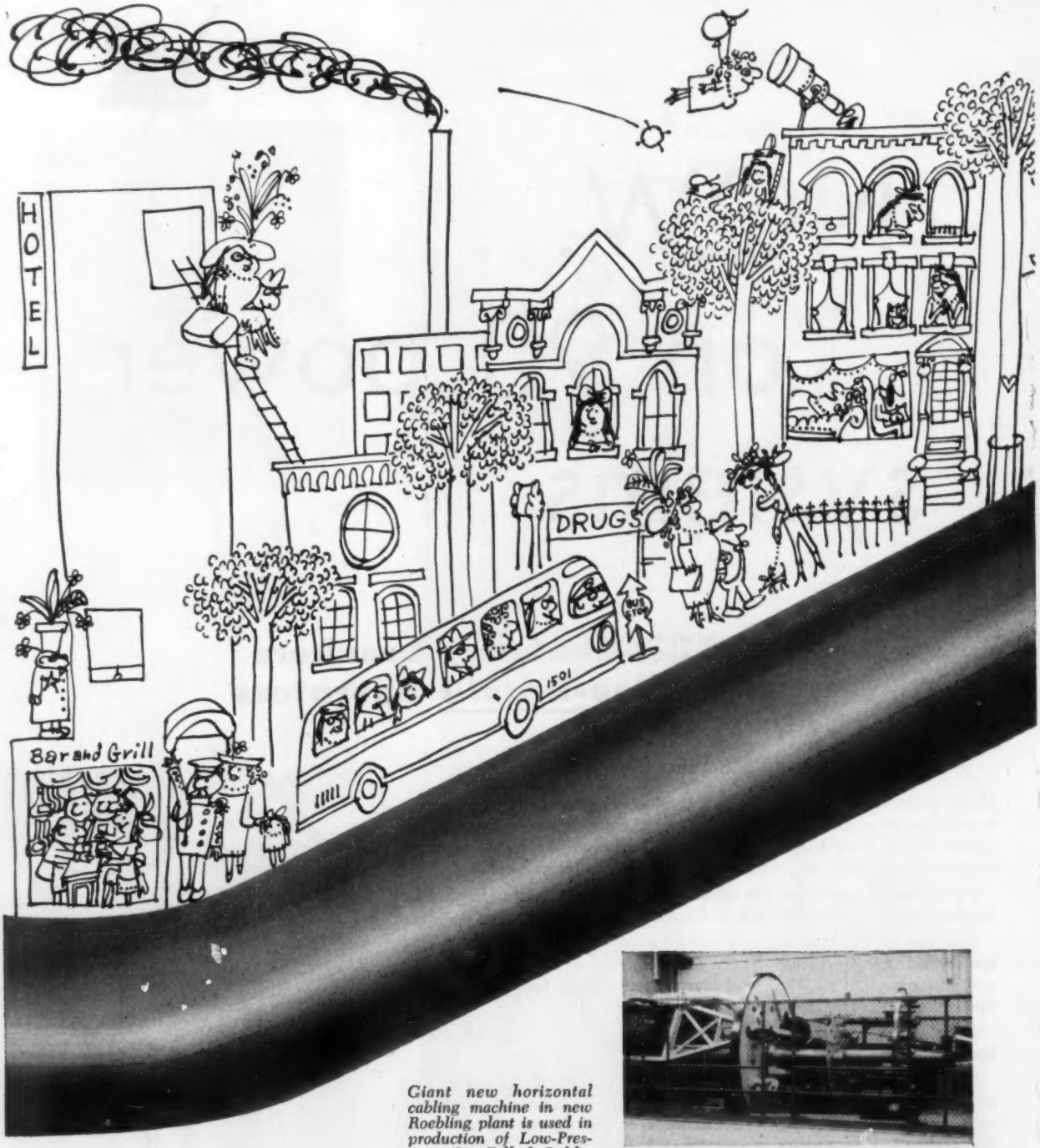
Features include: safe emergency closing of breaker at full rated speed onto energized line — *even when no control power is available;* and elimination of moisture and corrosion problems, because system is filled with oil.

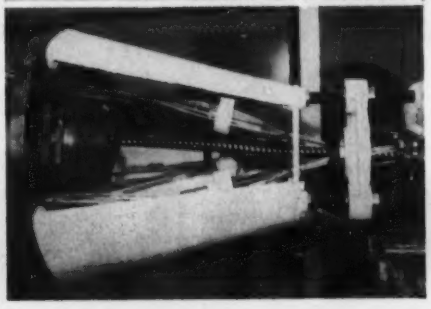
Other features of these breakers include: mechanically trip-free operation and high speed interrupting devices.

Join other utilities in taking advantage of the speed, reliability and low maintenance of A-C breakers with *Pneu-Draulic* operators. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

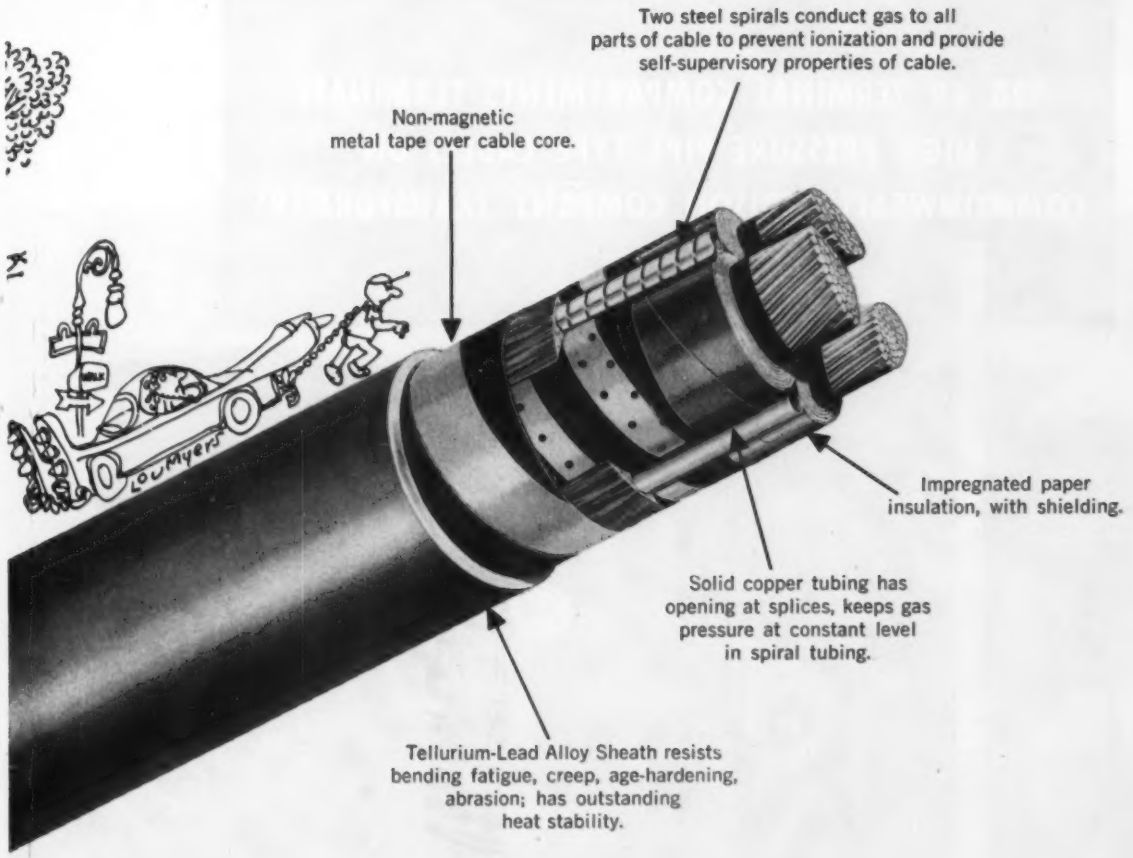
Pneu-Draulic is an Allis-Chalmers trademark.

CHALMERS





Giant new horizontal cabling machine in new Roebling plant is used in production of Low-Pressure Gas-Filled Cable. Here spirals, tube, insulated conductors and paper fillers are formed into cable.


Two steel spirals conduct gas to all parts of cable to prevent ionization and provide self-supervisory properties of cable.
Non-magnetic metal tape over cable core.
Impregnated paper insulation, with shielding.
Solid copper tubing has opening at splices, keeps gas pressure at constant level in spiral tubing.
Tellurium-Lead Alloy Sheath resists bending fatigue, creep, age-hardening, abrasion; has outstanding heat stability.

FOR **UPHILL POWER** PROBLEMS **ROEBLING GAS-FILLED CABLE!**

Packs more power in less space than solid-type cable!

When power circuit profiles include steep grades, there's no better means of power transmission than *Roebling Low-Pressure Gas-Filled Cable!* Here's why. When a solid-type cable is used for an installation of this kind, its oil impregnant inevitably drains to the bottom of the grade. Result? At the top, the cable becomes vulnerable to ionization. And oil pressure build-up at the base of the grade rapidly causes a rupture in the lead sheath, resulting in cable failure.

Roebling Low-Pressure Gas-Filled Cable (for voltages up to 46 kv) ends both these problems . . . and has other benefits besides! Dry nitrogen gas, inside the cable at approximately 12 psi pressure, effectively suppresses ionization. From the top of the grade to the bottom, internal pressure is uniform.

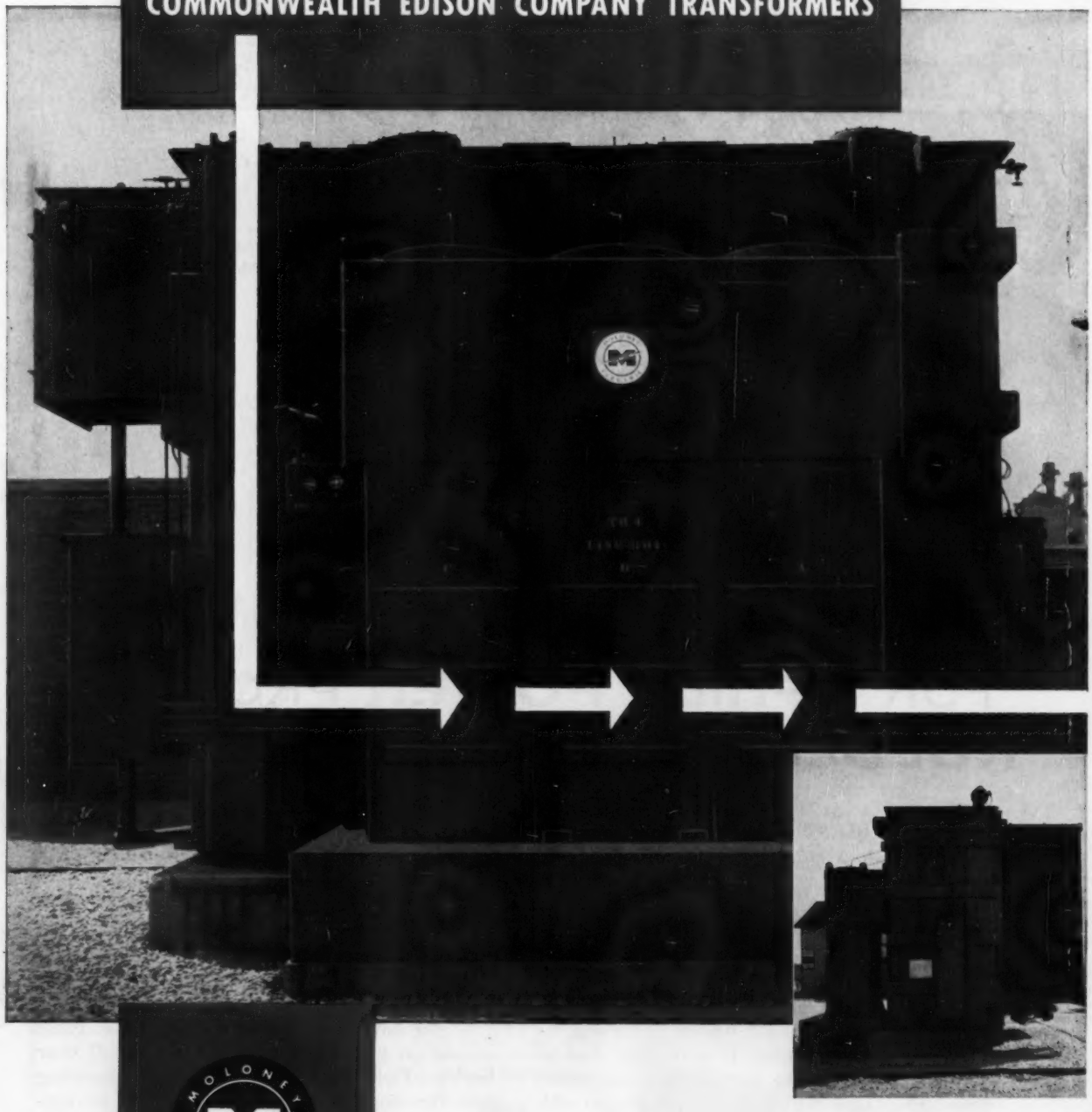
Another major advantage of Roebling Gas-Filled Cable is that it is self-supervisory. An alarm system immediately tells you if there's trouble along the line. And because this cable carries more power in a smaller diameter, existing manholes and conduits do not have to be altered.

If you have had trouble making power cable behave on grades (or anywhere else), call your Roebling Field Representative *today* about Roebling Low-Pressure Gas-Filled Cable! And for an eye-opening brochure, write Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, N. J.

ROEBLING

Branch Offices in Principal Cities • Subsidiary of The Colorado Fuel and Iron Corporation

138 KV TERMINAL COMPARTMENTS TERMINATE HIGH PRESSURE PIPE TYPE CABLES ON COMMONWEALTH EDISON COMPANY TRANSFORMERS



MOLONEY ELECTRIC

Manufacturers of Transformers for Utilities, Industry,

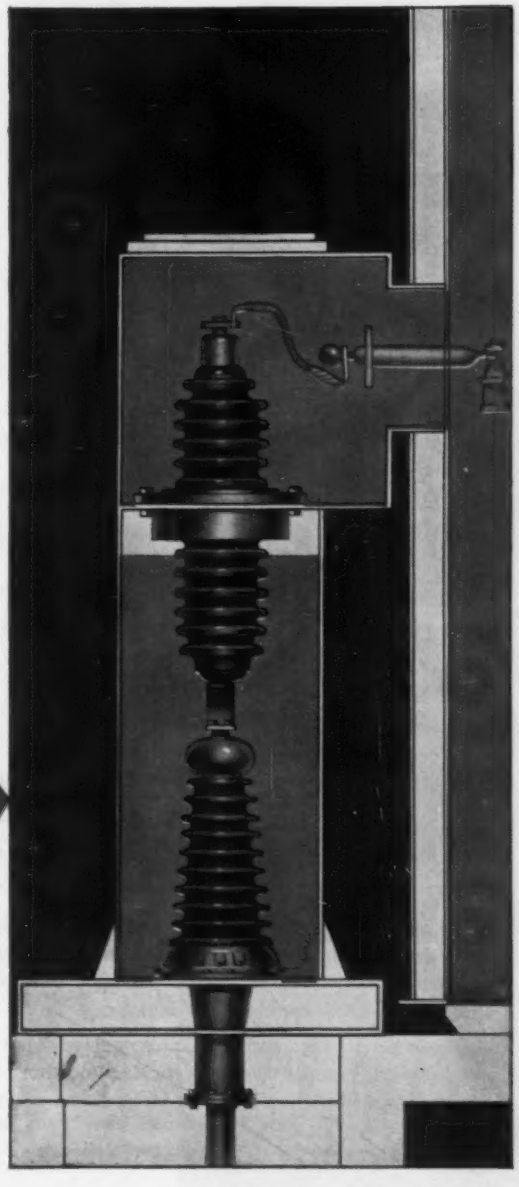
SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES

Provide Positive Isolation Of Cable Oil From Transformer In Event Of Cable Termination Leaks

To provide service in some areas of Chicago, Commonwealth Edison Company uses 138 KV lines, located underground, and therefore, 138 KV 200 PSI high-pressure, oil-filled cables are used.

Termination of a 138 KV line at a transformer presents the problem of preventing the cable oil from becoming mixed with the transformer oil in the event of a failure or a leak at the high voltage pothead termination. An effective solution to this problem is the two-compartment terminal chamber developed by Moloney in cooperation with Commonwealth Edison Company.

The upper compartment of the terminal chamber is attached to the transformer tank wall. Electrical connections from the transformer coils to barrier bushings installed in a partition between the upper and lower compartments of this terminal chamber are made through openings in the tank wall with transformer oil common to both the transformer tank and this upper terminal compartment. The lower compartment houses the high voltage potheads which are electrically connected to the lower terminals of the barrier bushings. This lower compartment is also filled with transformer oil and is equipped with a pressure relief vent, as well as a pressure-vacuum gauge and an oil level gauge having alarm contacts. Phase barriers are placed between the potheads.



In the case of even a slight leak of cable oil into the lower compartment, the pressure-vacuum gauge or the oil gauge will give indication of this condition and when the pressure or oil level reaches a predetermined point an alarm will be actuated. In event of an extremely bad leak the pressure relief vent will discharge excess oil.

Once again, Moloney, in cooperation with a customer, has developed a satisfactory answer to one of the day-to-day problems confronting the utilities.

Whatever your transformer problem, contact your Moloney representative for the benefit of more than sixty years experience in solving problems related to the design, manufacture and application of transformers. MEES-28

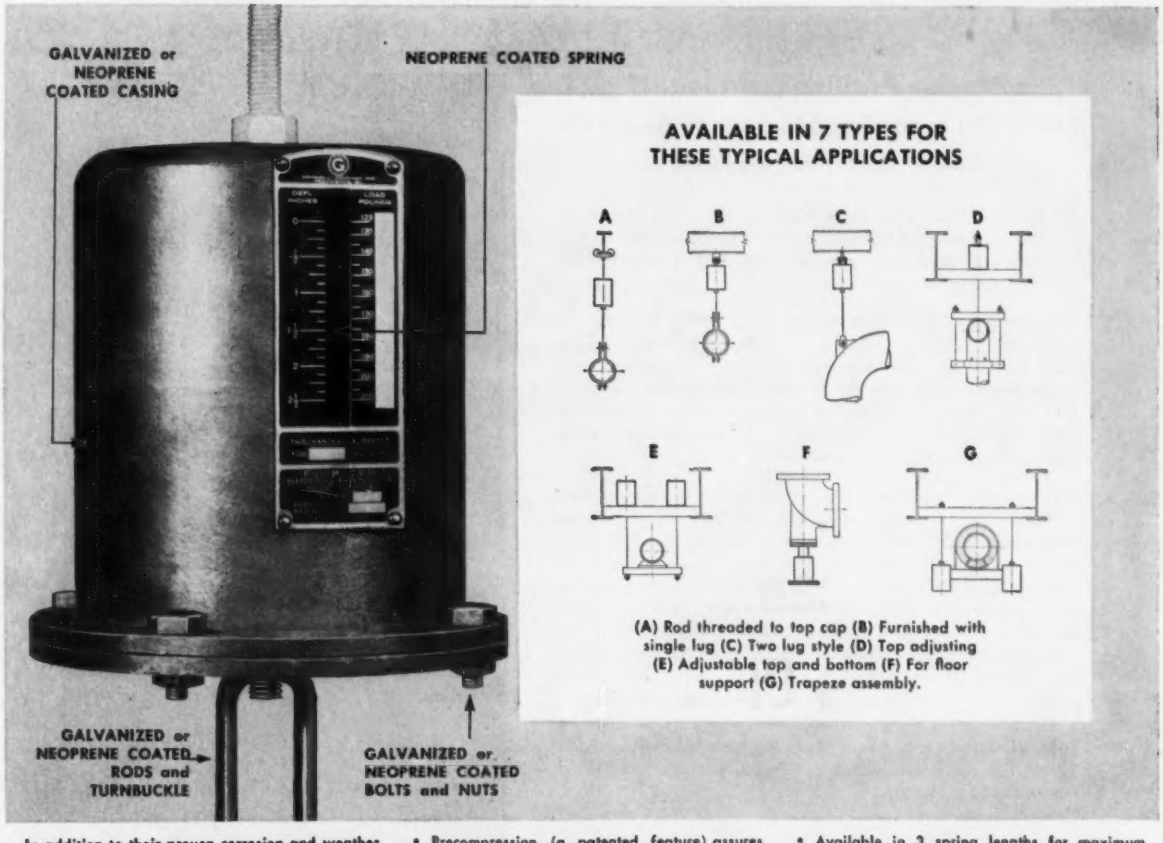
COMPANY

and Electronic Applications

AT ST. LOUIS 20, AND TORONTO, ONT., CANADA

corrosion-resistant, weather-resistant

GRINNELL VARIABLE SPRING HANGERS


GALVANIZED or NEOPRENE COATED CASING
NEOPRENE COATED SPRING
GALVANIZED or NEOPRENE COATED RODS and TURNBUCKLE
GALVANIZED or NEOPRENE COATED BOLTS and NUTS
AVAILABLE IN 7 TYPES FOR THESE TYPICAL APPLICATIONS
A
B
C
D
E
F
G
(A) Rod threaded to top cap (B) Furnished with single lug (C) Two lug style (D) Top adjusting (E) Adjustable top and bottom (F) For floor support (G) Trapeze assembly.

In addition to their proven corrosion and weather resistance, these spring hangers offer other features.

- **Maximum variation in supporting force for standard spring models per ½" of deflection is 10½% of rated capacity — in all sizes.**
- **Precompression (a patented feature) assures operation of spring within its proper working range, as well as saving valuable erection time. Reduced over-all height saves space.**
- **21 sizes available from stock for load ranges from 50 lbs. to 28,200 lbs.**
- **Available in 3 spring lengths for maximum travel of 1¼, 2½, and 5 inches.**
- **Installation simplified by integral load scale and travel indicators.**
- **All-steel welded construction meets pressure piping code.**

For hanger installations which are subject to highly corrosive industrial conditions — or where exposed to severe weather, Grinnell makes available two distinct lines of pre-engineered spring hangers.

These hangers are the result of extensive experimentation with various coatings for Grinnell's standard pre-engineered spring hangers. In addition to providing flexibility in pipe suspension, they provide versatility of application through their corrosion-resistant characteristics.

1. NEOPRENE COATED — for highly corrosive conditions, such as those found in chemical plants and refineries. All parts of the hanger are neoprene coated to protect the base metal from a wide range of corrosives. The flex life of the spring is unaffected by the neoprene . . . the coating resists cracking or flaking over a wide temperature range.

2. GALVANIZED — for outdoor installations, where weather conditions are severe. All parts of the hanger are galvanized except the spring, which is neoprene coated to avoid alterations of temper, hydrogen embrittlement and decreased flex-life of the spring — usual hazards to springs from the galvanizing process. Write for further details.

GRINNELL

AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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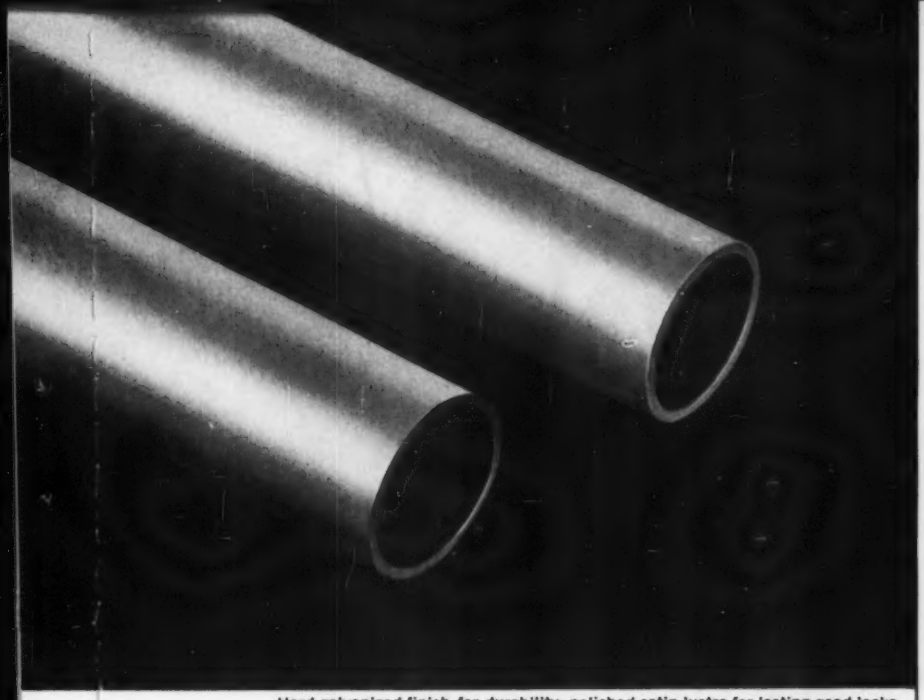


Hard galvanized finish for durability; polished satin lustre for lasting good looks.

Even EMT can look good ...if it's CIRTUBE* EMT

TRUE, the first things you look for in EMT are: one, is it easy to work with—two, is it made to give lasting protection. CIRTUBE EMT, by the way, rates tops on both. But there's no reason why EMT can't *look* good as well!

That's where CIRTUBE EMT "shines," too. Reason for its pleasing polished satin lustre is the cyanide zinc plating process Circle uses (even though it costs a little more to apply than other methods).

The zinc bond is better, too—won't chip or flake off. That's because Circle employs elaborate cleaning processes to make sure that the steel is absolutely clean before plating.

Quality finish is only one of many reasons why CIRTUBE EMT has gained such wide acceptance in so short a time. Why not try it next time you order—you'll like it.

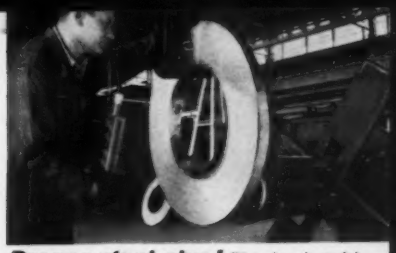
*Trade Mark

CIRCLE WIRE & CABLE
a subsidiary of
CERRO DE PASCO CORPORATION

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities

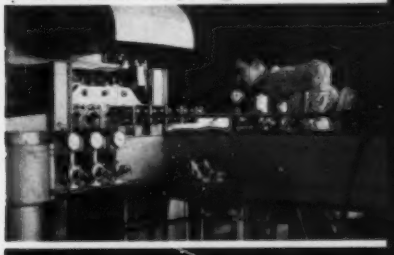
RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT

CIRTUBE EMT *Ask for it!*



Proper steel plus! The best cold rolled steel plus the right handling give CIRTUBE EMT its natural bendability.

Easy fishing! A baked-on protective coating gives CIRTUBE EMT a built in lubrication for easier wire pulling.



Split-free, bead-free! Induction welded CIRTUBE EMT, left, proves stronger than ordinary EMT, provides easier fishing.

Automated quality control! Automatic controls assure complete and continuing uniform quality of product.

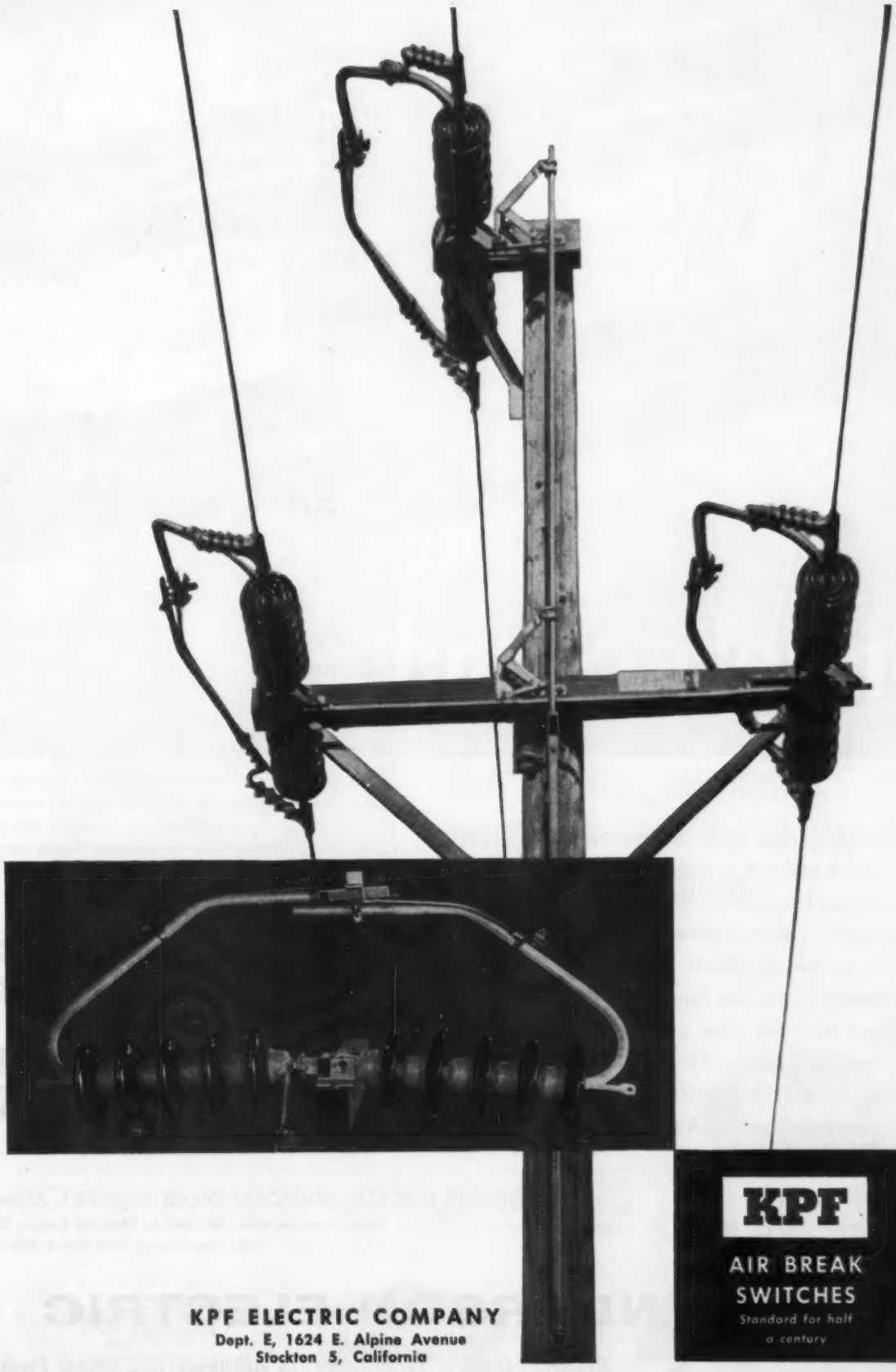
Tight, easily handled bundles! Bright, orange tapes hold CIRTUBE EMT securely for easy handling on and off the job.

Fast, friendly service! Well-known Circle service through a nation-wide network of well stocked nearby warehouses.

This look on a pole means KPF

No other air break switches look like KPF, or perform like KPF. The simple, functional design of KPF switches produces a clean pole top appearance. It also insures operating dependability in all weather. There are no delicate, complex mechanisms to freeze, lock, need lubrication or wear out. The light weight of rugged KPF switches means that no extra mounting structures are required.

Lower cost KPF switches have proved their advantages in over 50 years of service on major utilities. Make a test installation this month on your own system.

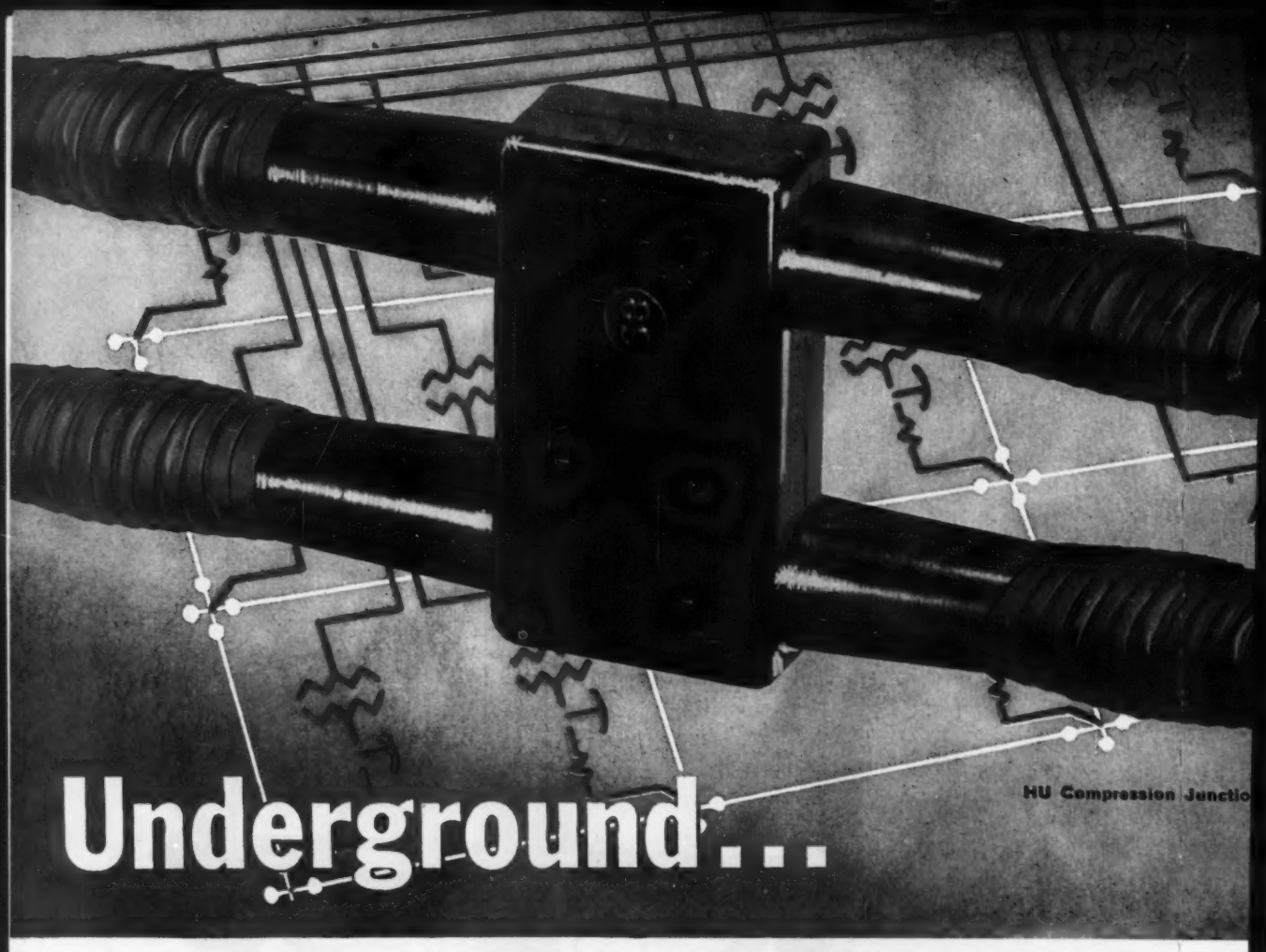


KPF

AIR BREAK SWITCHES

Standard for half a century

KPF ELECTRIC COMPANY
Dept. E, 1624 E. Alpine Avenue
Stockton 5, California



Underground...

HU Compression Junctio

Now! Anderson goes underground! In order to round out and complete its connector lines Anderson has entered the underground connector field . . . another forward step by Anderson in its continuing efforts to bring you the most advanced connectors for every application need. Shown here are three of our series of underground connectors. For details on these and other Anderson products write for our catalog or see your nearest Anderson representative.

HU Insulated Compression Junctions: available with four to twelve cable outlets. Designed for joining secondary network cables at junction points. Insulated with P-40 Performite rubber coated with neoprene. May be installed with standard indent tools.

HCL Compression Lugs: sizes to accommodate copper cable from #6 to 2000 MCM. May be installed with standard indent tools.

HCL Compression Lugs

SJA Split Tinned Sleeves: high conductivity copper, hot dip tinned according to latest EEI specifications.

SJA Split Tinned Sleeves

ANDERSON ELECTRIC CORPORATION • Birmingham 1, Alabama
Export Representative: International Standard Electric Corp.
50 Church Street, New York 7, New York

ANDERSON ELECTRIC

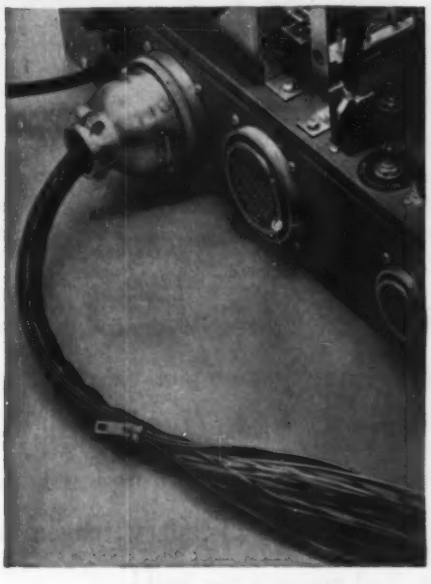
Research / Quality / Performance / in Aluminum and Bronze Products

Connectors • Clamps • Fittings • Accessories for SUBSTATION • TRANSMISSION • DISTRIBUTION • UNDERGROUND

Another new development using

B.F.Goodrich Chemical *raw materials*

"Zippertubing" is produced in standard lengths from 25 to 1000 feet, in varying sizes and colors, by The Zippertubing Company, Los Angeles. Shielding material used in it is manufactured by Cordo Chemical Corporation. B. F. Goodrich Chemical Company supplies the Geon polyvinyl material.



New shielding and jacket made with Geon can be zipped on in a single operation

Production and maintenance of wire harnesses are greatly simplified with this new shielding and jacket combination made with Geon polyvinyl material. All you do is zip it on. Saves time and equipment during manufacture—makes it easy to replace the jacket if it has to be removed to get at wiring for service.

For regular RF shielding, glass cloth saturated with Geon polyvinyl material is laminated to aluminum foil. It gives 100% coverage to provide immediate grounding of RF and UHF interference. The outer surface, also of Geon, has zipper tracks sealed in. A pull tab can easily be used to facilitate closure.

For heavier magnetic shielding, special steel foil is laminated between layers of Geon. Lead saturated glass cloth is available for radiation problems.

Geon provides high insulation resistance, heat stability and extra strength, as well as accuracy in molding. It's another example of versatile Geon proving the key to a dramatic new product. For information, write B.F. Goodrich Chemical Company, Dept. LR-12, 3135 Euclid Avenue, Cleveland 15, Ohio.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

SEE US AT BOOTH NO. 509
9TH NATIONAL
PLASTICS EXPOSITION
NOV. 17-21
INT'L AMPHITHEATRE—CHICAGO

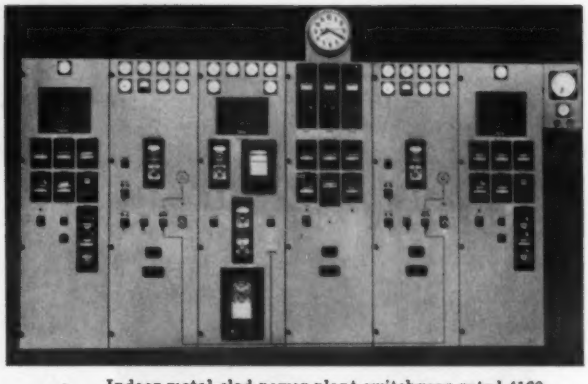
B.F.Goodrich

GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

in metal-clad switchgear...

Reliability

is born of many men's efforts



Indoor metal-clad power plant switchgear rated 4160 volts, 3 phase, 60 cycles supplied to a partially attended generating station.

It started with a directive—"Make it the best!" A creative team set out to implement this decision. Engineers, designers, production men, and marketing personnel—all took up the challenge. What was *then* good gave direction. They added their talents, their skill, their experience—up-to-date application requirements—designing, testing, redesigning until drawing board plans were translated to market place reality. Out came metal-clad switchgear pre-eminent in strength, simplicity, and performance. They *had* made it the best!

Type DST air circuit breaker—5 kv, 250 mva, 1200 amps.

From simple feeder circuits to complex generating station protection—when you specify Federal Pacific metal-clad switchgear, you specify reliability. Proof is yours for the asking. Write Federal Pacific Electric Company, Newark, New Jersey for Catalog 3-440—sixty-four pages of the latest in metal-clad switchgear information.

FEDERAL FPE PACIFIC

The Best in Electrical Distribution and Control Equipment

The Electrical Week

LATE NEWS ▶ **Cleveland Electric Illuminating wins rate hike** which will boost revenues about $5,850,000 in two years. This amounts to about half of what the company requested, according to a CEI spokesman.

AEC gets 86 proposals for studies of three reactor concepts (30 for boiling water; 26 pressurized water; and 30 organic-cooled) from 32 architect-engineering firms. Reports on first phase of work under each contract must be submitted by Mar. 23, 1959. AEC will submit initial results to JCAC by May 1, 1959.

Agriculture Dept writes Comptroller General Campbell that REA loan practices will not be changed to comply with his Oct. 15 ruling. Agriculture categorically denies every premise in Campbell's ruling (EW, Oct. 27, 1958).

Regulations governing the preservation of utilities' records have just been published by National Association of Railroads & Utilities Commissioners, P. O. Box 684, Washington 4, D. C. Price $1 per copy.

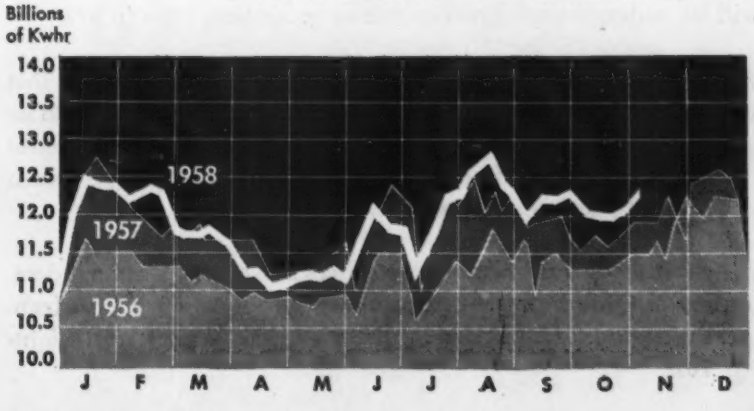
Klickitat County PUD gets FPC two-year priority permit to complete studies for proposed 177,000-kw hydro plant on White Salmon River.

Otter Tail Power will appeal to Stutsman County District Court on the North Dakota PSC denial of a 6% electric rate hike.

"Give Better Electrically" 16-page color ad appears in Nov. 15 issue of Saturday Evening Post. Ad, sponsored by 14 manufacturers, plugs 38 different electric products as Christmas gifts.

Management changes . . . Northwestern Public Service elects S. A. Moxness president, succeeding G. R. Arthur, retired. A. D. Schmidt becomes vp, operations . . . W. H. Ruese is upped to vp, operations, at Ohio Valley Electric Corp . . . Montana-Dakota Utilities elects J. E. Forester vp.

POWER OUTPUT—UP 4.0% (Week ending Nov. 1), Kwhr 12,330,000,000



Per Cent Change From Previous Year

	Oct. 18	Oct. 25	Nov. 1
Total U. S. ...	+3.1	+3.3	+4.0
New Eng. ...	+2.2	+5.3	+6.0
Mid. Atlantic.	+2.8	+3.1	+3.6
Cent. Ind. ..	−0.3	+0.2	+2.5
West Cent. ..	+1.8	+1.8	+3.5
Southeast ..	+3.5	+1.9	+2.9
South Cent. .	+7.6	+11.9	+7.3
Rocky Mount	+9.0	+9.7	+9.9
Pacific			
NW	−1.0	+1.6	+3.6
SW	+11.8	+7.7	+5.9

Seasonally Adjusted Index 238.5

Week Ago 237.4 Year Ago 229.2

Source: Edison Electric Institute

A TWO-MINUTE PREVIEW OF THIS ISSUE

EVENTS ▶ **The Democratic election sweep spells trouble for private power.** The new big Democratic majorities—more than 130 in the House and 28 in the Senate—mean that proponents of public power will have both the strength and favorable political atmosphere to put across their legislative programs. Specifically, it can mean:

- That TVA bond-financing has a good chance of being passed. This, in turn, could create precedents for similar TVA-type power authorities in other sections of the country.
- That any hopes of bringing private financing into REA-cooperative picture might just as well be abandoned.
- That the Eisenhower Administration will have a tougher time resisting Democratic demands for a bigger A-power program.

Although little good came out of the election from private power's viewpoint, there are signs that it is already planning strategy in dealing with the new, liberal Congress (p 56).

GE has come up with a plan to make A-power competitive by '65. In two parts, invitingly titled Operations "Sunrise" and "Know-How", the plan calls for a total expenditure of some $128 million by private companies, GE, and others. Read details on p 58.

You have to hand it to the Russians. When it comes to total power output, they're "one of the largest and fastest growing in the world." This is the consensus of ten top American power men who spent 16 days in a 5,000-mile tour of European Russia. This week's cover story in pictures on p 60.

TRANSMISSION ▶ **When is a high voltage transmission system needed,** and when does it become economical? Consumers Power Co set out to find the answers in an exhaustive engineering-economics study of 345-kv for its system. Principal finding: The company should and could retain present 138 kv system until system load hits 5,300 Mw (p 64).

A downtown switching station with eye appeal is in the offing for Newark on Public Service E&G's system. Everything in the station will be indoors in a modern, attractive building, and its 138-kv feeders will be underground. Breakers are to be air-blast type (p 67).

The role of digital computers for power system analysis requires that engineering data be automated on magnetic tape. Computer could be programmed to select correct data for a particular problem, could seek out "trouble spots" from which a new series of power system studies would be set up automatically (p 68).

Proper cleaning of transmission line splices is accented in visual demonstrations at Ohio Power. Tests are set up to show effects of cleaning . . . Pulley block helps raise insulator rings at Long Island Lighting (p 70).

GENERATION ▶ **Scale models help Consolidated Edison check collector designs** and calculations for two fly ash collectors. Model is of Plexiglas, and is complete with inlet flues, mechanical collector system and electrostatic precipitator. Scale is 1:16 **(p 78).**

A power sweeper in parking lots is saving Florida Power Corp about 300% over the former push-broom method . . . Improved design triples the life of ball mill inlet spiders used by Appalachian Power **(p 77).**

MANUFACTURERS ▶ **Westinghouse develops 1,000-F motor insulation.** Tests of a motor operating in that thermal environment for more than 100 hr and at 950-F for as long as 1,000 hr are said to prove the insulation's performance for electrical equipment required to operate at very high temperatures. Immediate possible use: supersonic planes, missiles and rockets . . . Aluminum, Ltd, of Canada is obtaining encouraging results from its research on the use of anodized aluminum for windings on motors, transformers and other equipment . . . Sierra Electronic Corp, Menlo Park, Calif, and U. S. Army Corps of Engineers have devised an electronic-telemetering system for measuring the water content of mountain snowpacks **(p 84).**

NEW EQUIPMENT ▶ **An interrupting device for standard 23, 34.5 and 46-kv** outdoor oil circuit breakers (Type FZO) is available. Known as Type LC, the cross-blast or side-exhaust interrupter is of the suicide type . . . Enclosed circuit breakers feature "visible break" design . . . Insulated jumper clamps in two new styles are now available **(p 92).**

SELLING ▶ **What can you buy for a penny?** When a Minneapolis girl reporter found out and wrote a story about it, Northern States Power Co admen capitalized on it with an ad 24 hrs later that showed all that electricity could do for a penny **(p 98).**

MANAGEMENT ▶ **What will business be spending for new plants and equipment** in 1959? For the answer turn to **page 101** which shows some of the highlights in the McGraw-Hill survey just released. Plans are being revised upwards from last spring's figures. They already show a small increase over 1958. This year's cutback is estimated at 15%.

PEOPLE ▶ **W. I. Turner has been elected the new president** of the Canadian Electrical Manufacturers Association. He is the president of Canadian Controllers Limited, Toronto . . . The new officers of the electrical operating section of the Wisconsin Utilities Association are: G. K. Hickman, chairman, and F. W. Nolte, vice-chairman. F. J. Kripps, Northern States Power Company, is the retiring chairman. Hickman is a transmission engineer with Wisconsin Electric Power Company and Nolte is with the Wisconsin Public Service Company **(p 108).**

Management is fundamentally an intellectual process, not a mechanistic one. But many successful business men believe that this intellectual process cannot be taught; it must be learned by experience. The author of a recently published book entitled, **"Management, Principles and Practices"** thinks otherwise. Based on the assumption that this process can be analyzed, the author has subdivided his text into the purpose, principles, and human relationship of management.—**Management, Principles And Practices. By Dalton E. McFarland. Published by The Macmillan Co, 60 Fifth Ave, New York 11, N. Y. 604 pages, illustrated. Price $9.25.**

TECHNICAL NOTES

Corrosion of aluminum clad fuel elements in water-cooled nuclear reactors can be inhibited if the water is slightly acid.

Forcing fresh air into the base of power plant stacks may assist dispersal or maintain high stack velocities at low loads or during adverse wind conditions.

Growing inclination to ignore broken wire assumptions in transmission tower design is resulting in weight reductions of 25% and cost reductions of 10%.

Rock fines decrease bleeding, increase strength and improve water tightness in concrete. But they should not be used in great quantity because they lower durability under freezing and thawing, lower resistance against corrosion by sulphate solutions, and in some cases increase the dry shrinkage.

Pressures for steam power plants much above 3,500 psi are difficult to justify today once the saving has been made in eliminating the boiler drum and achieving the lower turbine cost. Potential gains are appreciably offset by additional equipment costs, the risk to availability, and the federal income tax on incremental savings.

FROM EDITORS IN THE FIELD

To provide greater safety during work on 154-kv H-frames, Tennessee Valley Authority is connecting the two shield wires together between the tops of each structure with 5/16-in. S.M. guy wire. This wire is easier to handle and stronger than the two No. 4 iron wires formerly used.

"Why is a Hump in a Cotter Pin so Important?"

Used on O-B Hardware, Humped Cotters Save Hours Compared to Conventional type

How many cotter pins do your line crews install and remove in a year? Chances are the total runs into the thousands . . . thousands of opportunities for time to be wasted . . . plus countless other opportunities to forget to bend the end as is required on a standard cotter pin, or to bend it improperly.

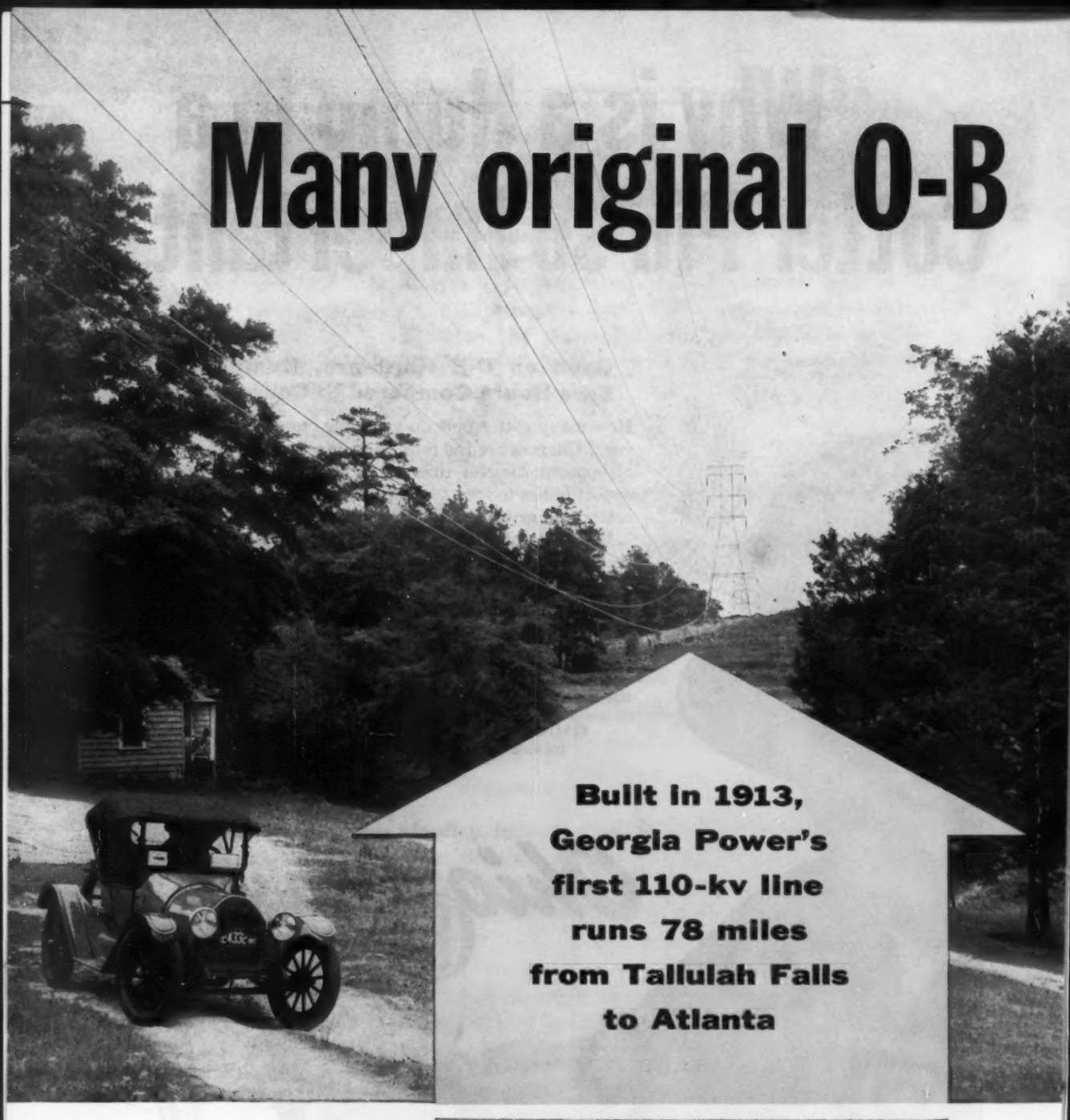
But O-B cotter pins have a hump. That means the ends don't have to be bent. The pin goes in easily. It stays regardless of how much vibration there is. And it can be pulled out just as quickly as it was put in . . . no ends to unbend before removal.

A hump in a cotter pin is a little thing, but it has obvious benefits for the user of O-B hardware. This is typical of the design features that characterize the O-B hardware line . . . from the smallest to the largest items the line is made for the user's convenience.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

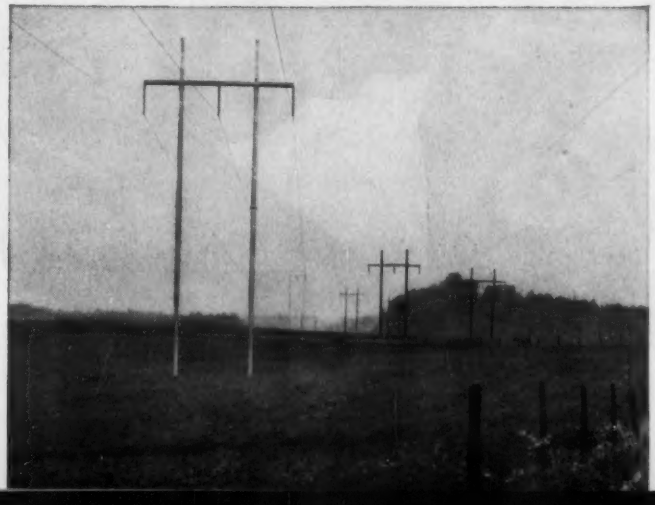
Humped cotter is ideal for hot line work.

Many original O-B



Built in 1913, Georgia Power's first 110-kv line runs 78 miles from Tallulah Falls to Atlanta

4886-H



Modern 230-kv and 110-kv lines are still built with O-B insulators.

insulators still serve

When Georgia Power built its 110-kv Tallulah Falls line from a hydroelectric site in northeast Georgia to Atlanta, there was considerable doubt as to whether the Company would ever be able to sell all the power that the 60,000-kw of generating capacity at Tallulah Falls provided.

There was also some concern about the new suspension insulators of that day. Considerable technical data, backed by laboratory experience, indicated the new O-B design was a good one.

But proof of performance was lacking.

Now there is proof in abundance, and probably no better proof than a look at the Tallulah Falls line as it is today.

Tallulah Falls Today

The insulator design that was looked upon with skepticism in 1913 has become the industry standard of today. Many of the O-B suspension units installed during the line's early years are still in service. No longer is the 110-kv line, built in 1913, the backbone of the transmission system. The company that was worrying about building load for its 60,000-kw plant at Tallulah Falls in 1913 now has a system capacity of 1,813,000 kw.

New Transmission Lines at Georgia Power

Comparing the Tallulah Falls design with the 110-kv lines built with steel towers since World War II shows surprisingly little difference. But in more recent years, most of the 110-kv construction has been on wood H-frame towers.

On its new 230-kv lines, Georgia Power has been using guyed tubular steel towers. Each pole on the line consists of two sections of tapered steel tube bolted together. Conductors are supported from a steel channel crossarm.

Modern O-B suspension insulators are still standard for both 110-kv and 230-kv construction.

And what about the Tallulah Falls plant, the one that supplied too much power in 1914? Now power flows from Atlanta to the plant because the area around Tallulah Falls needs more power than the plant can supply.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass

USS Tiger Brand Electrical Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

Cuts time and cost of highway lighting...

Tiger Brand Type RR Cable

Are you or your customers in on any highway lighting jobs?

It could be a good source of business. Even at the local level, it is big!

With the new 41,000-mile Federal Highway Program rolling along . . . and many additional miles of thruways and boulevards planned or under construction, the lighting of intersections and service areas is a challenging opportunity for alert electrical contractors and suppliers.

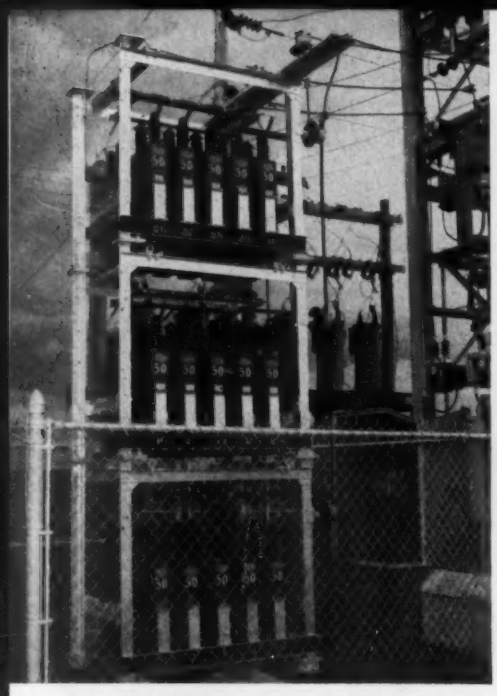
American Steel & Wire makes a cable that's especially designed for underground installation. Known as Tiger Brand Type RR Cable, it meets all requirements for outdoor lighting installations. Sheathed with an outer jacket of tough, resilient Neoprene, Type RR Cable can be buried directly in the soil, thus eliminating the necessity for ducts, conduits and other external protection. It is light in weight, easy to handle and more economical to install.

For further information about Type RR Cable and other Tiger Brand electrical wires and cables, get in touch with our nearest sales office, or write direct to American Steel & Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio.

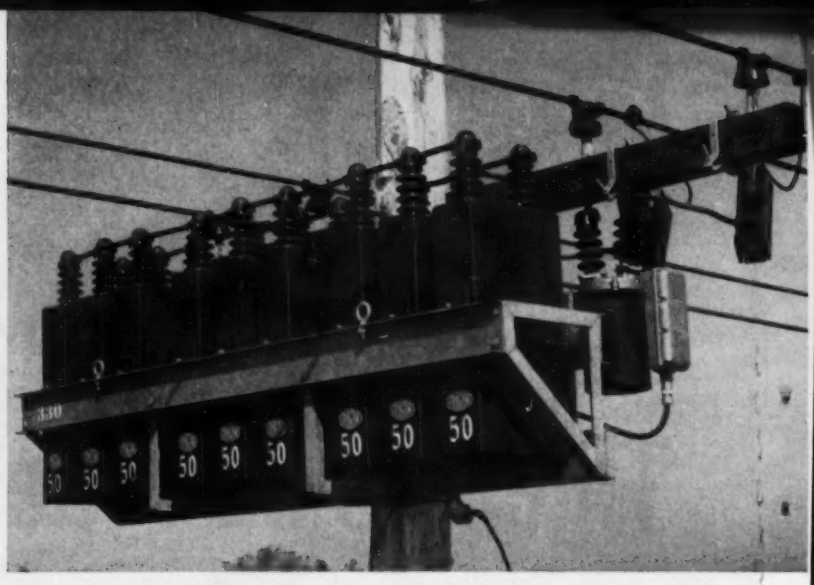
USS and Tiger Brand are registered trademarks

American Steel & Wire Division of USS **United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad



OPEN-TYPE EQUIPMENTS... Singlephase stacking units can be arranged in combination to give any desired bank kvar at subtransmission and transmission voltages. Three phase open-type racks are available for small bank installations at substations.



AUTOVAR EQUIPMENTS... These factory-assembled, pre-wired pole-type equipments permit fast, easy, and low cost capacitor installation on distribution circuits—available in multi-row, in-line, cluster mount, or designs to user specications.

SANGAMO can fill all the *MOST COMPLETE*

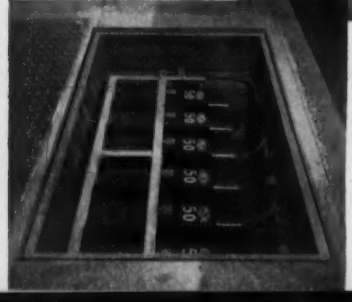
Whether you install power factor improvement capacitors in banked high voltage units or as individual low voltage units, you can make Sangamo your primary source of supply for all your capacitor needs.

Sangamo offers the most extensive line of primary and secondary capacitors, equipments, and controls available from any manufacturer.

For more information ask your Sangamo Representative or write for Bulletins 1110, 1130 and 1131.

INDIVIDUAL UNITS... Sangamo 15, 25 and 50 kvar primary power capacitors are built to utility engineers' specifications to assure "performance stability." They are stocked in all NEMA voltage ratings, and special ratings can be readily supplied.

HOUSED CAPACITOR EQUIPMENTS... Engineered for safety and appearance, Sangamo housed capacitor equipments provide a compact installation. They can be supplied with automatic control, and with or without circuit breakers.



UNDERGROUND EQUIPMENTS...These enclosed submersible primary capacitors provide kvars in locations where overhead pole space is not available. Capacitor units are completely sealed to guard against mosture or submersion in underground vaults.

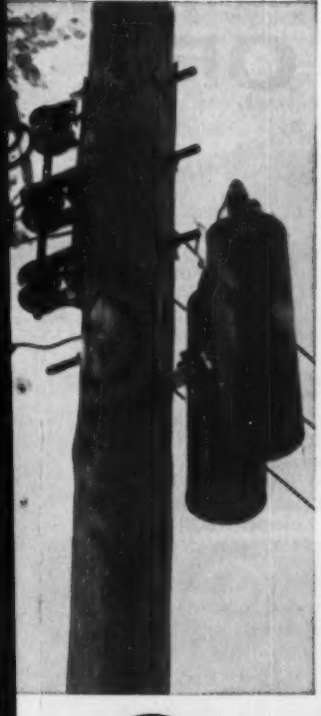
Type S Plug-in 2 kvar unit, for meter socket mounting.

Type N Nipple connected 3 kvar unit, for three phase service.

Type N Nipple connected 1 kvar unit, for adjacent mounting.

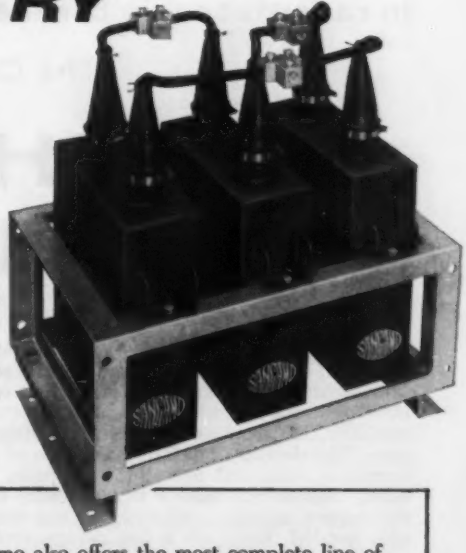
SECOVAR SECONDARY CAPACITORS... Only Sangamo can offer these 240 volt capacitors for installation at the customer's service to give maximum system benefits all down the line. They give the advantages of low first cost–quick and easy installation–installation off the pole. Secovar capacitors are available in three types with optional thermostatic switch for automatic operation.

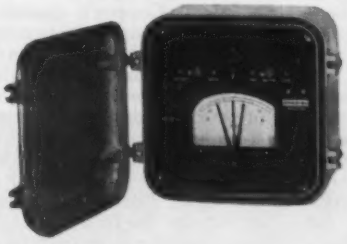
your capacitor needs from *LINE IN THE INDUSTRY*



SECONDARY CAPACITORS... Pole-type secondary capacitors for mounting directly to pole or cross arm. Indicating type fuses are available.

SUBMERSIBLE SECONDARY CAPACITORS ... These secondary capacitors are completely sealed against moisture. Ideal for low voltage underground network installations. Available in factory-assembled equipments to fit your needs.





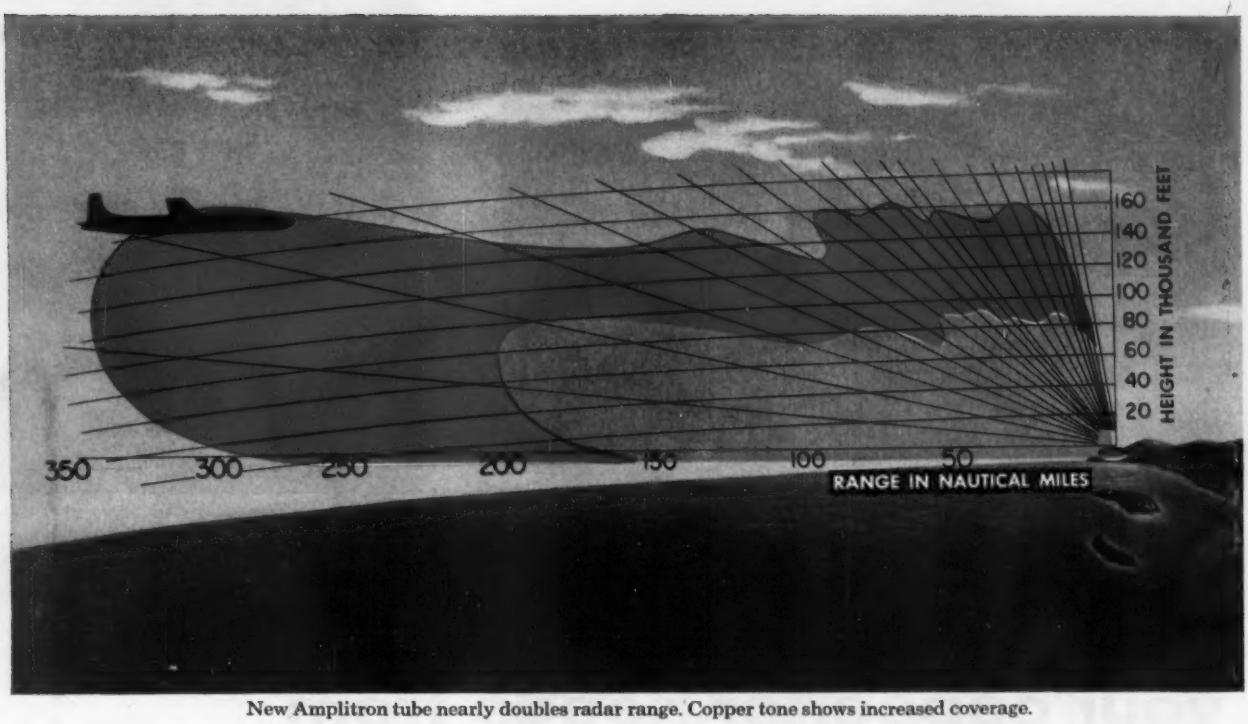
Sangamo also offers the most complete line of automatic controls for your capacitor installations. Whether you wish to switch capacitors as a function of voltage, current, watts, vars, temperature, time–or combinations of these–Sangamo can supply a control for your application. No other manufacturer offers this variety.

PC58-S

LIVE BETTER ELECTRICALLY

SANGAMO Electric Company

SPRINGFIELD, ILLINOIS



New Amplitron tube nearly doubles radar range. Copper tone shows increased coverage.

In radar tubes, in breaker contacts, electrically and structurally...

The COPPER METALS meet

THE CHALLENGE OF RELIABILITY

Increased maintenance costs and the increased complexity of most military and commercial products have laid greater stress on the reliability of electrical and electronic components. What the customers want, essentially, is predictable service life without maintenance. The designer faces the problems of temperature, corrosion, material and joint strength, fatigue and many others. His answer is frequently found among the copper metals — whether or not conductivity is also needed. Here are a few design problems where reliability was vital, and where copper or a copper alloy contributed to the solution:

Design Problem—Radar booster tube

Raytheon's Amplitron* is a new type of tube capable of power amplification at microwave frequencies. It boosts the output power of an existing radar installation by 8 to 14 times, and nearly doubles its range. Dependable performance is essential, whether used for military aircraft detection or commercial aircraft guidance. The design problems included extreme mechanical accuracy, durable connections, heat dissipation and vacuum retention. The solution to all of these was oxygen-free, high-conductivity copper.

The anode cavity (diagram above) depends on very tight tolerances for proper performance. Yet in some models it can be formed out of a solid blank of copper by cold forging — with a single press stroke. Copper's malleability makes this possible. The many connections can be brazed reliably because of copper's good joining properties.

With an output above 4 megawatts, heat could be a problem. Copper's thermal conductivity handles it. The good high temperature characteristics of this copper are enhanced by its freedom from oxygen traces, eliminating oxidation, scale formation and conductivity losses. The very high (50-70%) electrical efficiency of the tube depends, of course, on copper's electrical conductivity.

Vacuum retention in a tube of such complex geometry depends on two other characteristics of this grade of copper. The metal is nonporous, and its high purity eliminates the formation of gaseous products. The vacuum envelope is therefore secure, because nothing seeps in and nothing is generated within it.

Raytheon says, *"Without copper, the Amplitron would have been impossible."*

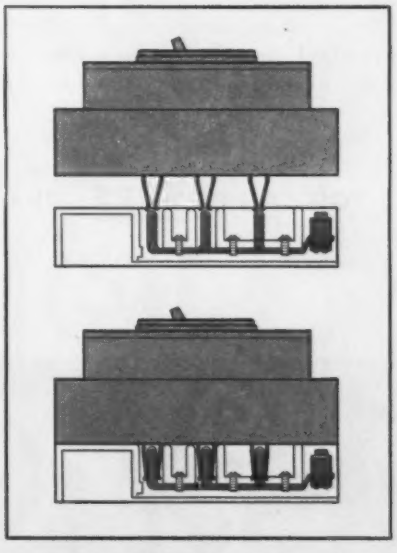
*Raytheon Trade Mark

Schematic diagram of Amplitron tube ➡

Reliable performance depends on conductivity, vacuum retention and accurate fabrication. Copper makes it possible. Complete Amplitron unit shown at left.

Design Problem—Plug-in breaker connections

Federal Pacific Electric Company's "STABreaker" circuit breakers plug right into the panelboard to permit changing units and ratings without bolting and unbolting. Dependable performance of the connectors is essential to circuit continuity and to avoid heating and false tripping. The design problems included high fatigue strength, spring qualities, easy cold working, reliable welded connections and, of course, electrical conductivity. The solution to the problem was found in Phosphor Bronze 5%. The result was an excellent electrical connection and a dependable one.



"STABreaker" plugs into panelboard. Enduring spring qualities of Phosphor Bronze 5% assure a reliable contact.

Design Problem—Yours

Whenever reliability determines design, the copper metals should be investigated. They have many properties besides conductivity that can help enhance the maintenance-free service life of your product. The Copper & Brass Research Association, 420 Lexington Ave., New York 17, N. Y., will be happy to cooperate in your investigation.

THERE'S A NEW FRONTIER IN . . .

COPPER · BRASS · BRONZE

New SHELTERFOR-M service area...

For modern integrated substation design

Now Westinghouse provides, for the first time, one integral structure to house switchgear, operating aisle, maintenance and storage area. Costly, space-consuming outbuildings are eliminated. All the substation structures are consolidated into one low, compact group that is easily landscaped to make it a good neighbor in crowded suburban developments.

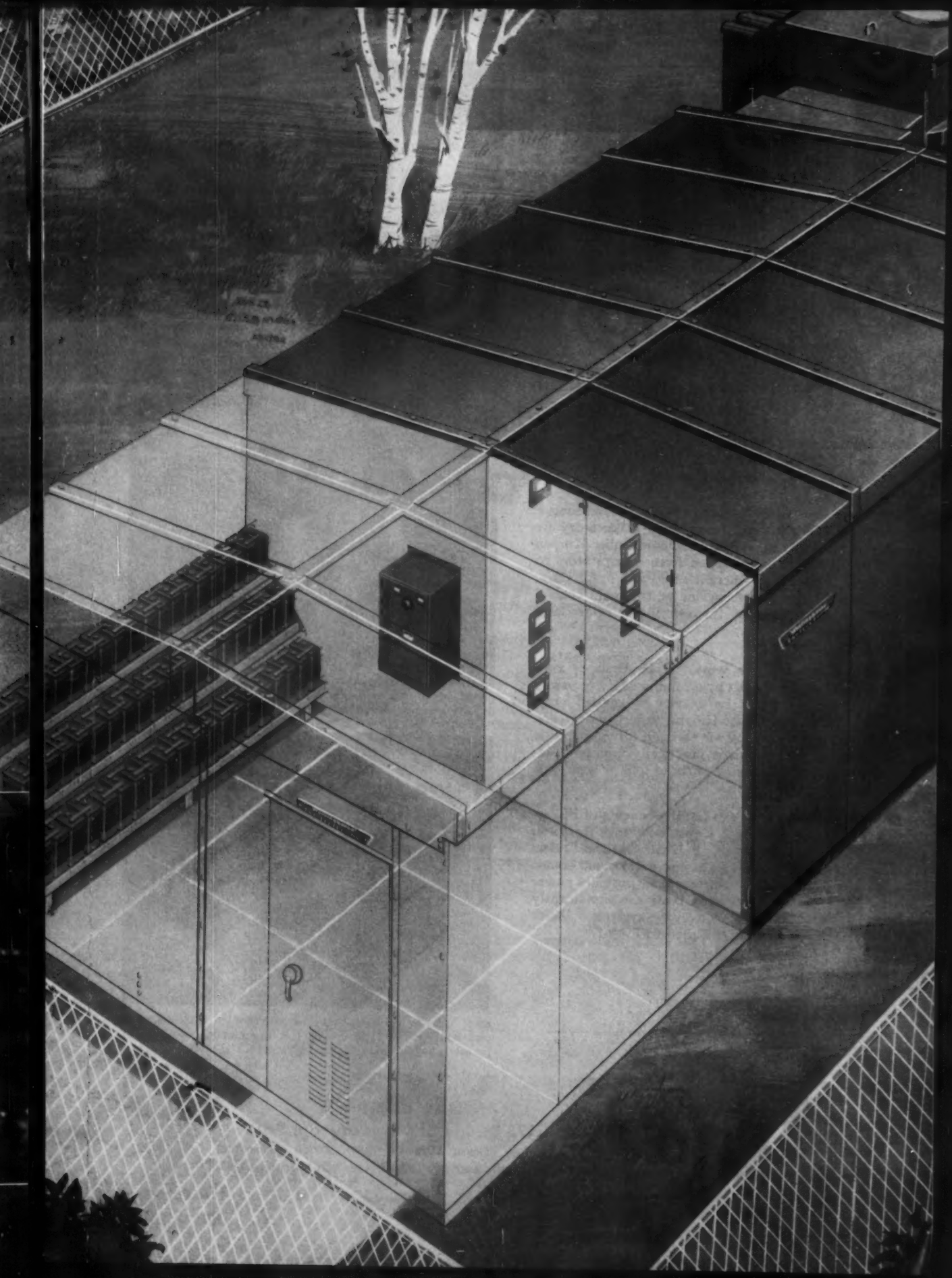
Standard three-foot panels provide flexibility for expansion. Service Area is readily erected by two men with standard tools in a few hours.

Control batteries can be located near breakers to eliminate expensive conduit runs and reduce voltage drops associated with long runs.

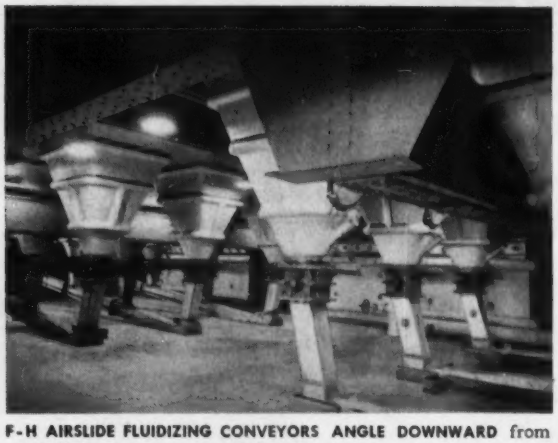
Call your Westinghouse Sales Engineer today to learn about additional ways you can save in your substation designs. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60943

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS



How Commonwealth Edison Turned a Fly Ash Problem Into Profit



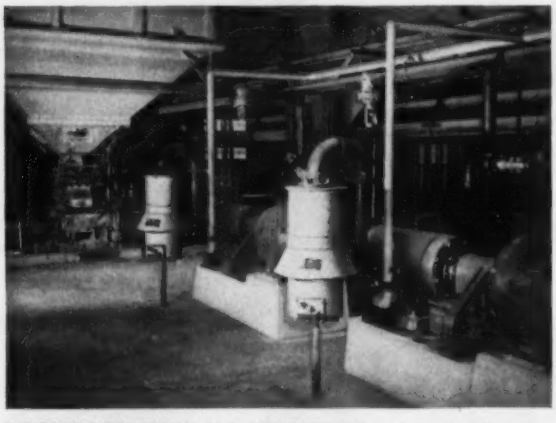
F-H AIRSLIDE FLUIDIZING CONVEYORS ANGLE DOWNWARD from precipitator hoppers, move air-activated ash to 20-ton central surge hoppers under floor. There are few moving parts.

At Commonwealth Edison's State Line Station, about 350 tons of fly ash a day had to be wet down, loaded, and trucked to suitable dumping sites.

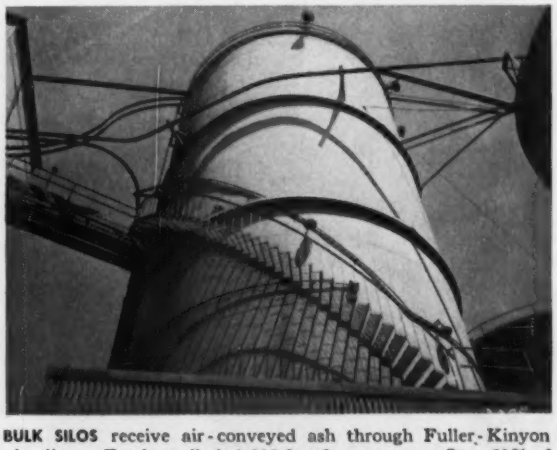
Waste becomes profit. Today, the plant burning a peak load of 5000 tons of coal daily collects dry fly ash automatically in a totally enclosed Fuller-Kinyon system. The ash is conveyed from precipitators to storage bins and silos, where it's sold as a by-product. Manpower: just three men, one at the main control panel and two bagging the ash for sales to local contractors.

Air and gravity do the work. F-H Airslide® conveyors fluidize dry fly ash by a column of low-pressure air for easy movement by gravity to central surge hoppers. Then, a Fuller-Kinyon pump under each hopper drives the ash by air through a five-inch line to storage. The system is practically maintenance-free. There are few moving parts to foul or wear out.

Large and small plants can get the benefits of Fuller-Kinyon fly ash handling. Capacities range from 100 to 8,000 cubic feet an hour. F-H Airslide and Fuller-Kinyon conveying lines can be curved to avoid beams and other obstacles. Low-pressure air provides power inexpensively and installation costs are significantly less than other types of conveying systems. Write for detailed information in Bulletin FF-49-1.



FULLER-KINYON PUMPS AND COMPRESSORS under surge hoppers propel ash to bins and silos at 20 tons an hour. Fluidized by air, the abrasive, 300°F. ash moves without injuring system.



BULK SILOS receive air-conveyed ash through Fuller-Kinyon pipe-lines. Farthest silo is 1,000 feet from pumps. Over 50% of fly ash is bagged and sold as a by-product.

1335
G-203

Fuller
....pioneers in harnessing AIR

FULLER COMPANY
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SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION
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FULLER COMPANY GENERAL AMERICAN TRADE MARK

the price is RIGHT!

TYPE M STRAND

If someone asked you the price of Copperweld Strand, the chances are that you'd err on the high side. Why?

Simply because this permanently non-rusting guy and messenger strand has for more than 40 years been rated absolute tops in its field. Judged by the admittedly longer service and maintenance-free life its use assures, you'd naturally expect it to cost more—much more. But that's no longer true.

Now, with the new Type M Strand, you can obtain all the money-saving and performance advantages of Copperweld construction at a price comparable to that of ordinary strand. This was made possible by developing new higher strengths especially suited for guy and messenger use, and introducing new cost-cutting production techniques.

Pliable and easy to handle, this superior strand is available in a complete range of breaking strengths. Ask us to quote on your guy and messenger requirements. You'll find the price is right.

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION *Glassport, Pa.*
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Furnished in coils of 250, 500 and 1,000 feet depending on the size. Reels of 2,500, 5,000 and 10,000 feet are also available.

Copperweld®

TYPE M

GUY and MESSENGER STRAND

There Is No Magic Formula for Producing Substations, as Southern States Has Found from 910 Installations

As much as we like the idea of standardization, the one thing we have learned is that there is no cut-and-dried, assembly-line, easy way to produce substations.

We've been at it 28 years, producing more than 900 substations of all kinds, and it has always been tough for us!

Even stations with essentially the same assignments have endless arrangements. Infinite combinations of design preclude standardization. Each station must be virtually a custom-made project.

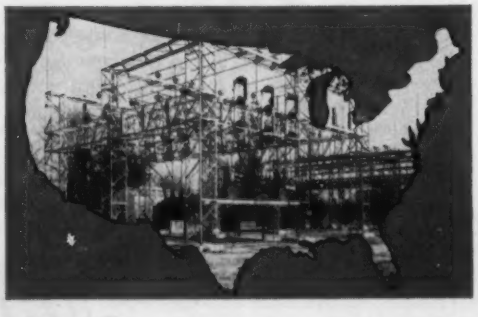
True, hundreds of designs in our files are helpful. Many standard components are picked up and used, with ultimate savings to our customers. And the practical experience of our design staff guides us around many pitfalls.

But you can't escape the fact that supplying substations requires these basic functions: skillful engineering, careful detailing, precise coordination of production schedules, and delivery on time. At least, that's what we've learned. And that's how Southern States approaches every substation assignment.

On this basis, you might like to do business with us. We'll welcome your inquiry. Just call your Southern States representative or write direct to us.

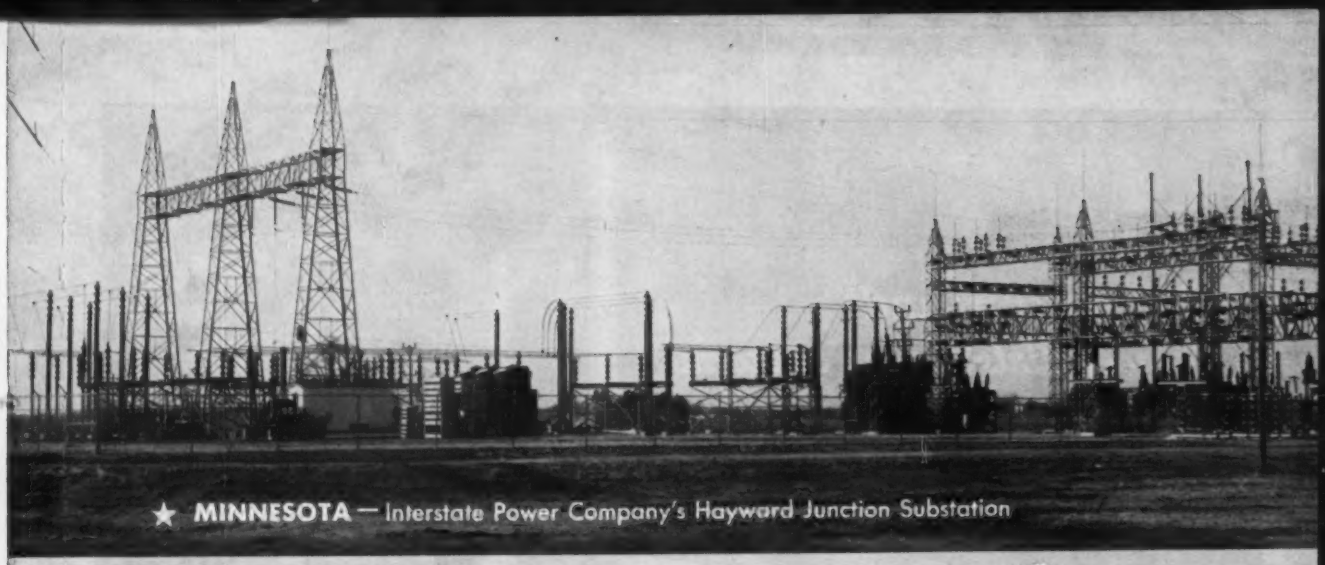
SOUTHERN STATES SUBSTATIONS ARE IN USE ALL OVER THE NATION

During the past 28 years Southern States has produced 910 outdoor substations for hundreds of different customers. The stations range from small 5,000 kva units to switchyards exceeding 1,000,000 kva. Regardless of size, Southern States pays close attention to every detail—from the single-line wiring diagram to the finished station.



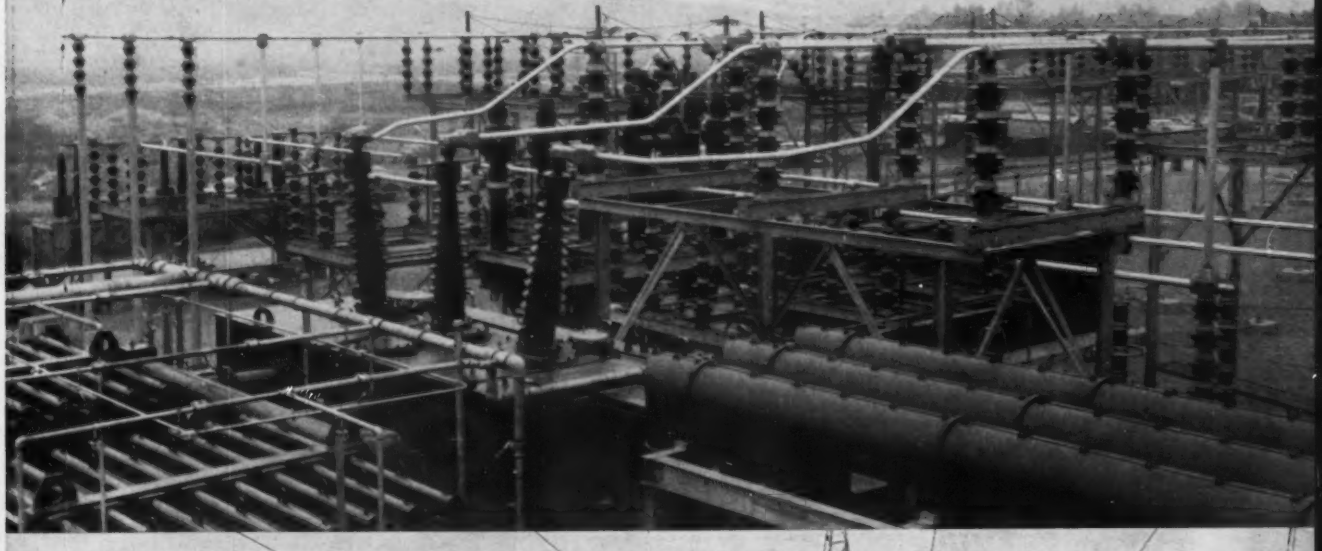
SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

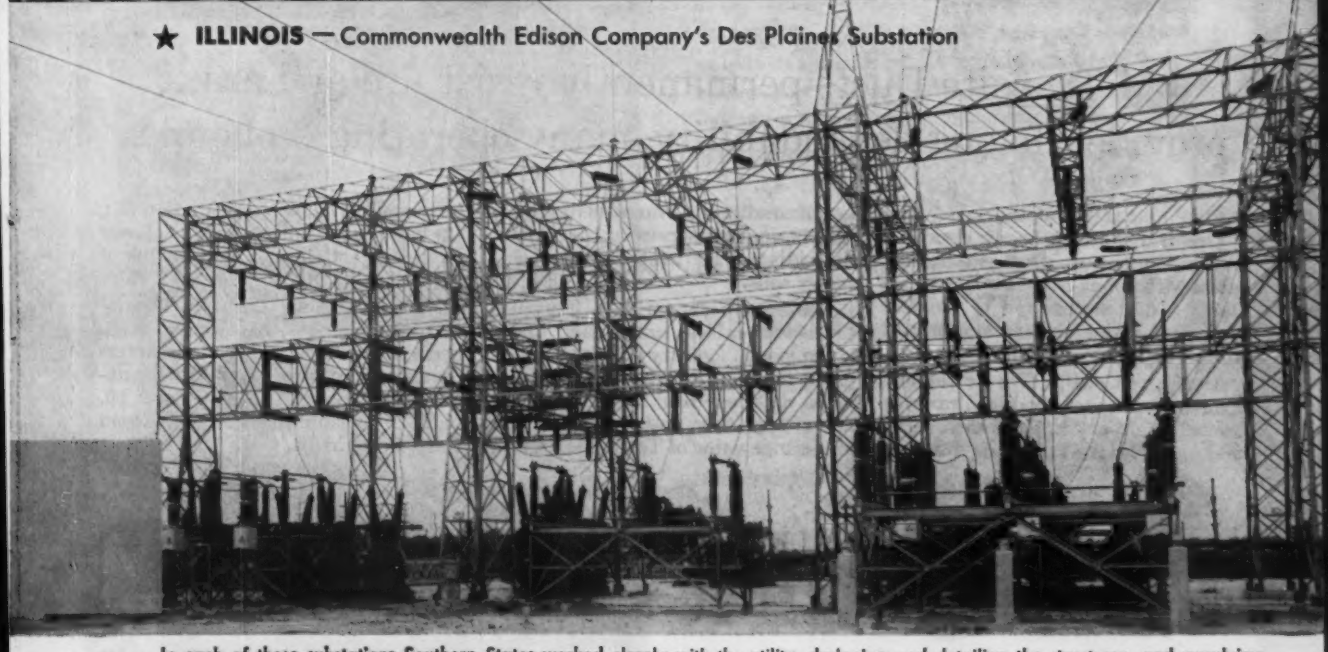


★ **MINNESOTA** — Interstate Power Company's Hayward Junction Substation

★ **NEW YORK** — Consolidated Edison's Corona Substation



★ **ILLINOIS** — Commonwealth Edison Company's Des Plaines Substation



In each of these substations Southern States worked closely with the utility, designing and detailing the structures; and supplying many components, including structural steel, air break switches, disconnects, buses, cable conductors, connectors, and bus supports.

Underground distribution system savings begin the day you decide to install J-M Transite Ducts. You can figure on lower operating costs, prolonged insulation life, more reliable service and longer cable life.

J-M Transite Ducts permanently resist fire and arc... provide lifelong dependability, many operating economies

GONE ARE MANY of the headaches of transmitting heavy electrical loads underground, when you protect cables with Johns-Manville Transite® Ducts. They assure you of greatest protective value, and maximum load capacity, per dollar invested.

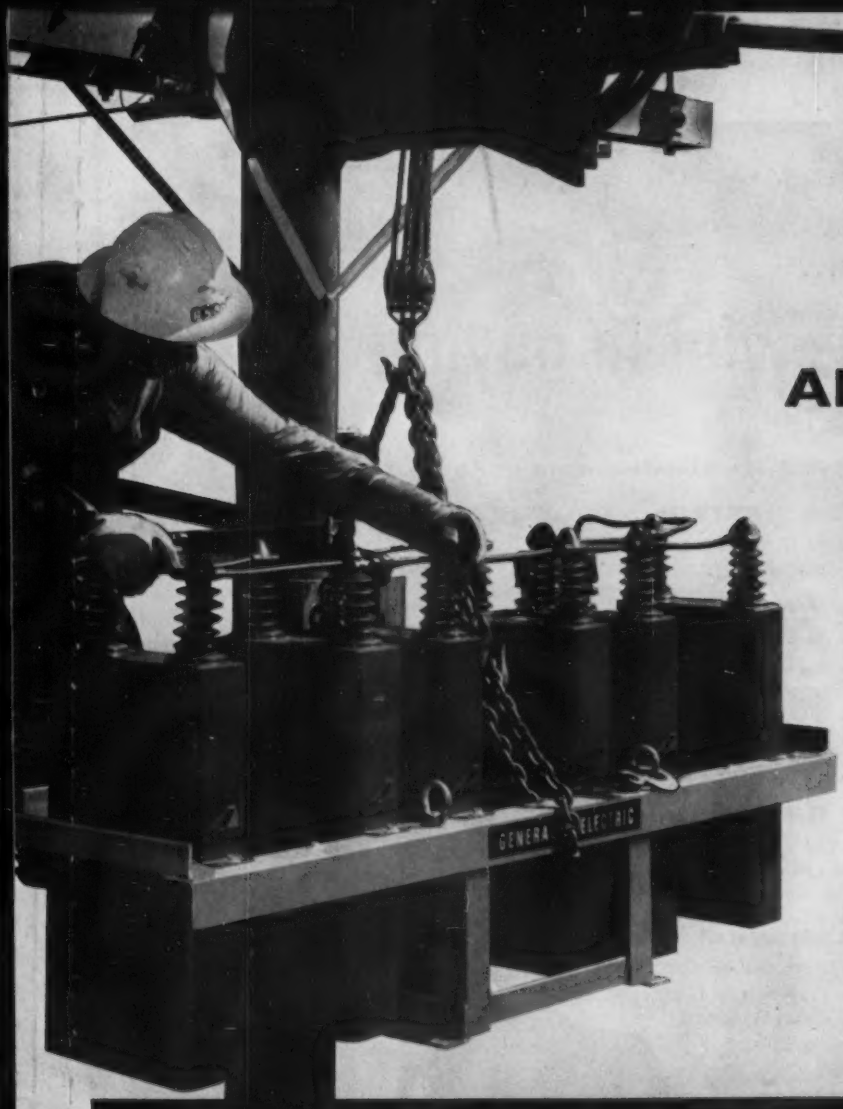
And when cable fire or failure occurs, noncombustible Transite Ducts remain undamaged and can be used again for the new lines. Regardless of conditions, Transite Ducts provide permanent service as they do not deteriorate from heat, water or corrosive soils.

Tests have shown that Transite-protected cables run cooler under given loads . . . carry greater loads at given temperatures because Transite helps dissipate heat faster. And for lower operating costs, consider the long-range value of Transite Ducts in terms of (1) increased insulation life, (2) fewer cable failures, and (3) lower I^2R losses for the full working life of a system.

For details on Transite Ducts' many advantages, distribution engineers are invited to write for informative brochure EL-29A. Johns-Manville, Box 14, New York 16, N.Y. In Canada, 565 Lakeshore Road East, Port Credit, Ont.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS



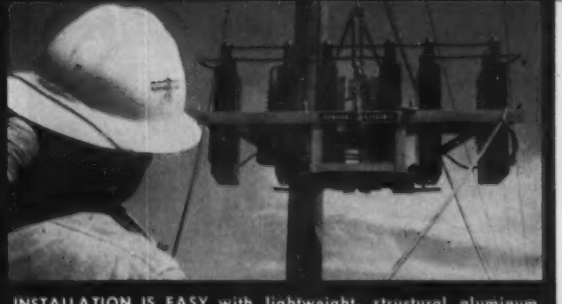
ANOTHER GENERAL ELECTRIC

KILOVAR PLUS

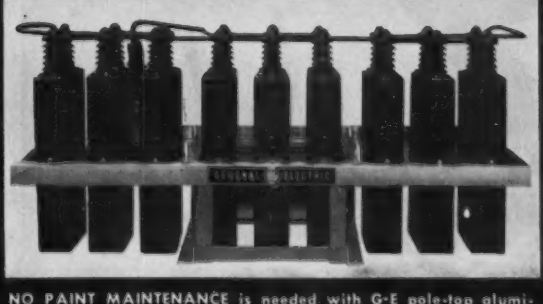
TO HELP YOU CUT INSTALLATION AND MAINTENANCE COSTS . . .

New Aluminum-rack Pole-top Capacitors

- **Lightweight and factory-assembled for easy installation, less strain on pole**
- **Corrosion-resistant to require less maintenance**
- **Braced to front-of-pole for maximum free climbing space**



INSTALLATION IS EASY with lightweight, structural aluminum racks and front-of-pole brackets and mounting arrangement.



NO PAINT MAINTENANCE is needed with G-E pole-top aluminum racks and stainless steel capacitor cases, helping to cut costs.

15–20% less weight of G-E factory-assembled pole-top capacitor equipments in aluminum racks makes installation fast, easy and inexpensive, and reduces bending moment on the pole.

Maintenance costs are low, too. Rugged, jig-welded aluminum structure will not require protective painting, even if drilled in the field. And, G.E.'s stainless steel capacitor case requires no protective paint maintenance.

Front-of-pole mounting and bracing affords ample free climbing space, provides greater safety, and contributes to ease of installation and connection to system.

For more information contact your G-E Apparatus Sales Office, or write to Section 445-21, General Electric Company, Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

GUY-GRIP dead-ends...

the modern twist in guying

The picture comp[illegible] GUY-GRIP dead-end benefits obv[illegible]

1. THE ASSEMBLY LOOKS BETTER...
slim, modern GUY-GRIP dead-ends, free from bolts, give your guying jobs a finished, craftsmanlike appearance.

2. YOU SAVE *HOURS* OF COSTLY TIME...
takes only a minute to install a GUY-GRIP dead-end — about the same time spent in securing one nut and bolt.

3. YOU ELIMINATE ALL TOOLS...
wrenches, pliers, and other tools are completely unnecessary in applying GUY-GRIP dead-ends. The operation is done entirely by hand.

4. ASSURES POSITIVE GRIP...
under all field conditions, whether the guy is relaxed or under tension. Once the legs of the GUY-GRIP dead-end are entirely applied to the strand, you *know* the assembly is complete and permanent.

5. RESISTS STRAINS AND WEATHER...
GUY-GRIP dead-ends can take an unbelievable beating. Tension, impact, temperature extremes . . . whatever force is exerted against GUY-GRIP dead-ends, they withstand the most extreme conditions, never relinquishing a single ounce of their gripping power.

These are only a few of the many reasons why you might want to try the modern twist in guying. Write for more information: Preformed Line Products Company, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland.

PLP 10 years of Power Line Progress

You can look up to

Preformed

Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.

New amplifier battles "noise"

Four-stage junction diode amplifier was developed at Bell Telephone Laboratories by Rudolf Engelbrecht for military applications. Operates on the "varactor" principle, utilizing the variable capacitance of diodes. With 400-mc. signal, the gain is 10 db. over the 100-mc. band.

The tremendous possibilities of semiconductor science are again illustrated by a recent development from Bell Telephone Laboratories. The development began with research which Bell Laboratories scientists were conducting for the U. S. Army Signal Corps. The objective was to reduce the "noise" in UHF and microwave receivers and thus increase their ability to pick up weak signals.

The scientists attacked the problem by conducting a thorough study of the capabilities of semiconductor junction diodes. These studies led to the conclusion that junction diodes could be made to amplify efficiently at UHF and microwave frequencies. This was something that had never been done before. The theory indicated that such an amplifier would be exceptionally free of noise.

At Bell Laboratories, development engineers proved the point by developing a new kind of amplifier in which the active elements are junction diodes. As predicted, it is extremely low in noise and efficiently amplifies over a wide band of frequencies.

The new amplifier is now being developed for U. S. Army Ordnance radar equipment. But it has numerous other possibilities. In radio astronomy, for example, it could be used to detect weaker signals from outer space. In telephony, it offers a way to increase the distance between relay stations in line-of-sight or over-the-horizon communications.

BELL TELEPHONE LABORATORIES

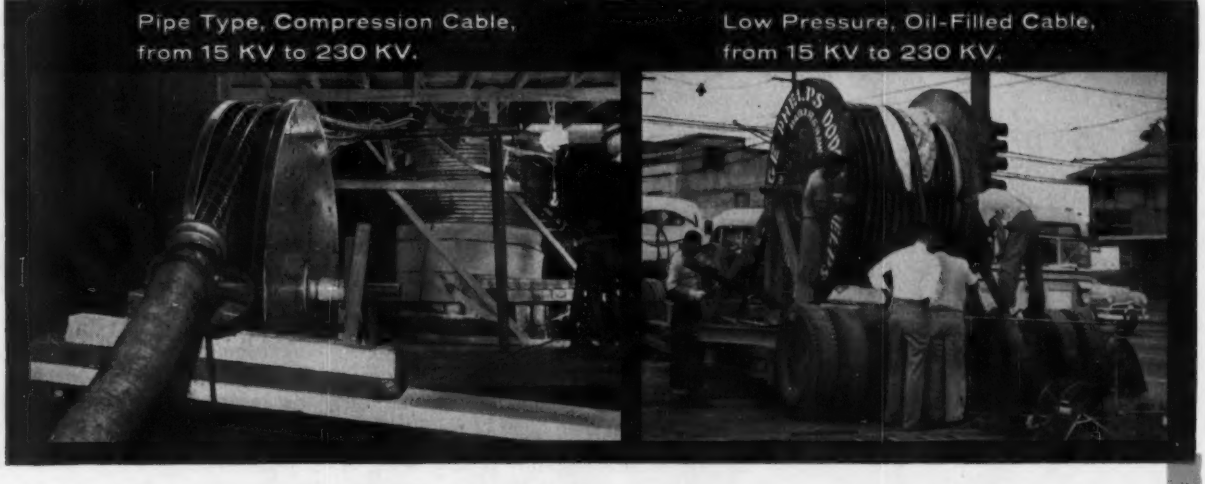
WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Phelps Dodge

WIDEST RANGE OF HIGH

Pipe Type, Compression Cable, from 15 KV to 230 KV.

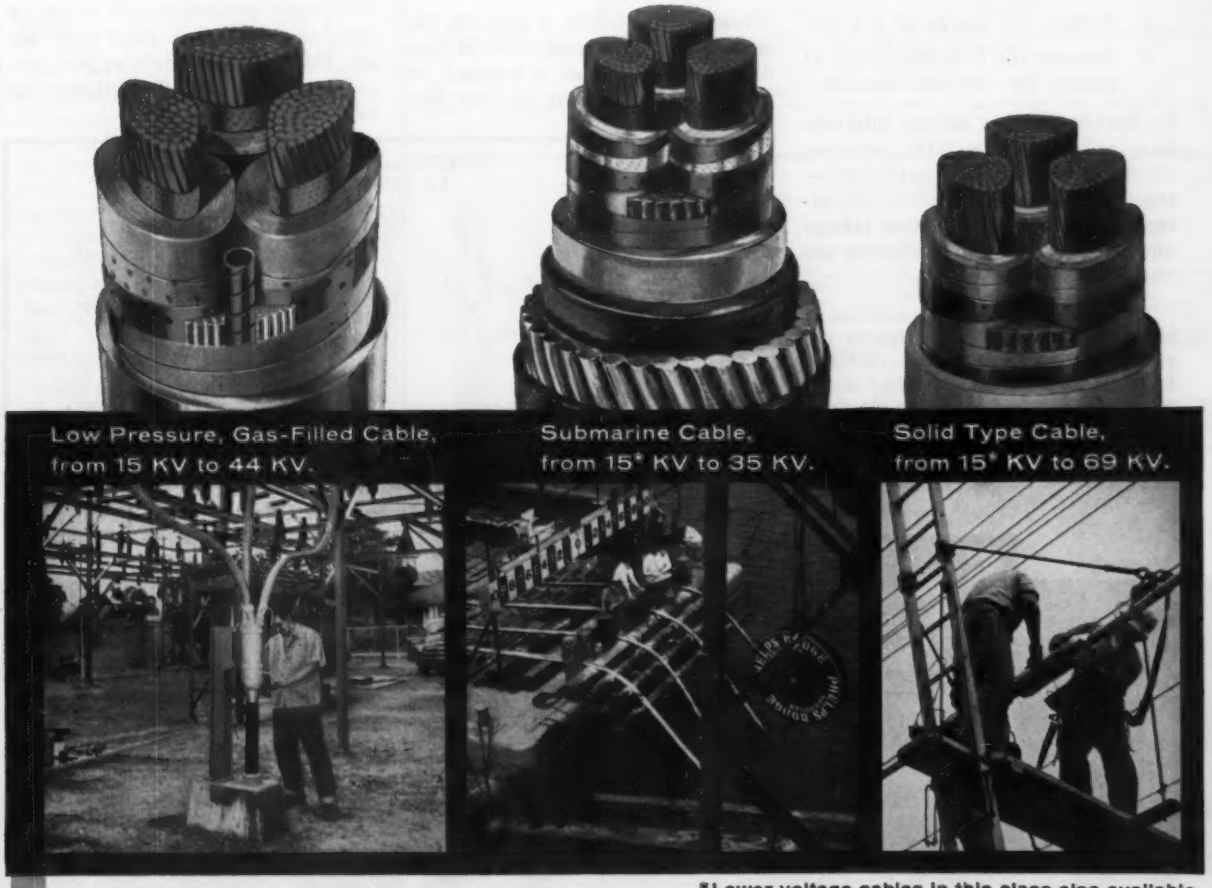
Low Pressure, Oil-Filled Cable, from 15 KV to 230 KV.



Consult Phelps Dodge for the correct answer to your requirements, regardless of voltage or type!

offers Industry's VOLTAGE POWER CABLE!

Only Phelps Dodge has manufacturing experience and operational "know how" with the entire range of high voltage cables which includes: oil compression, gas compression, high pressure oil, high pressure gas, pipe type cables; medium pressure gas, low pressure oil-filled, low pressure gas, submarine and solid type cables.



*Lower voltage cables in this class also available.

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, N. Y.

These S&C Cutouts reduce by shortening the arc,

As any lineman who has closed a cutout on a heavy fault knows, there's a violent blast of flame and "shrapnel." There are three ways to cut down this hazard:

1. Reduce the amount of fuse tube liner (fibre) exposed to the arc.
2. Reduce the energy of the arc.
3. Increase the bore diameter* to reduce the "muzzle velocity."

In S&C's Cutouts having interrupting ratings above 5000 amperes, all three methods are employed — together — making possible the exceptionally high interrupting ratings and at the same time reducing the violence of the blast.

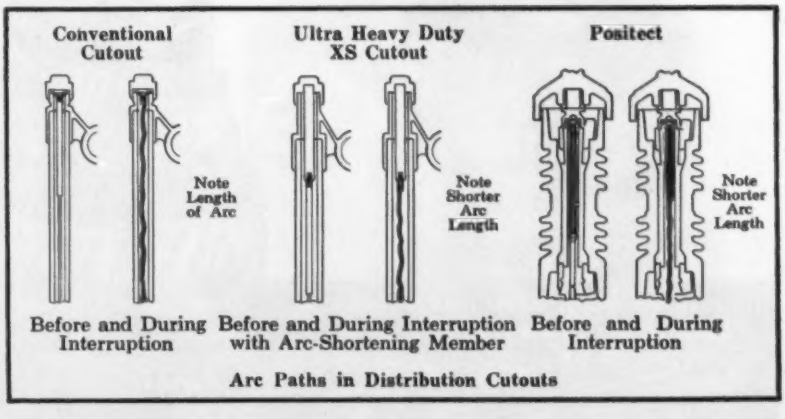
*This can be done without sacrifice of low fault interrupting capability by use of a fuse link made to interrupt low faults, in combination with a high speed terminal-separating device. In the Positect, this latter is a spring and cable assembly; in the XS, a spring-actuated cable flipper.

Here's how it's done:

The length of the arc is deliberately reduced by the use of an arc-shortening member. In the XS Cutout, this member is a husky copper rod; in the Positect, the member is a spring-and-cable assembly.

When the arc length is reduced, the arc voltage is reduced, and in turn the energy in the arc is reduced. At the same time, the arc has less fibre to act upon, and hence less gas is generated. Finally, with a somewhat larger bore in which to expand, the gases are not as violently accelerated out of the cutout's open end.

The result: less energy, less flame, less violence, and less hazard. And while such performance is of special importance at the highest fault levels, this same reduction applies proportionately across the entire range of faults.



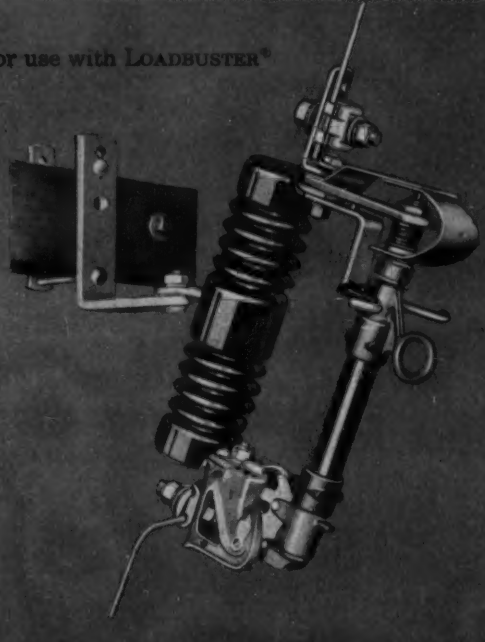
Arc Paths in Distribution Cutouts

For voltages up to 14.4 kv

XS CUTOUTS

Open cutouts designed for use with LOADBUSTER®

This open cutout is designed for use on modern distribution systems to provide for the two performance factors of most concern: reliable interruption of the heaviest faults with minimum violence and to provide repetitive load switching capability. Available in Extra Heavy Duty and Ultra Heavy Duty styles with arc-shortening rod at 7.2 kv and 14.4 kv. (Also Heavy Duty styles at 7.2 kv, 14.4 kv, 25 kv, and 34.5 kv.) The XS Cutout can switch full rated loads up to 200 amperes with disconnect blade at 14.4 kv when used with LOADBUSTER, the portable loadbreak tool.

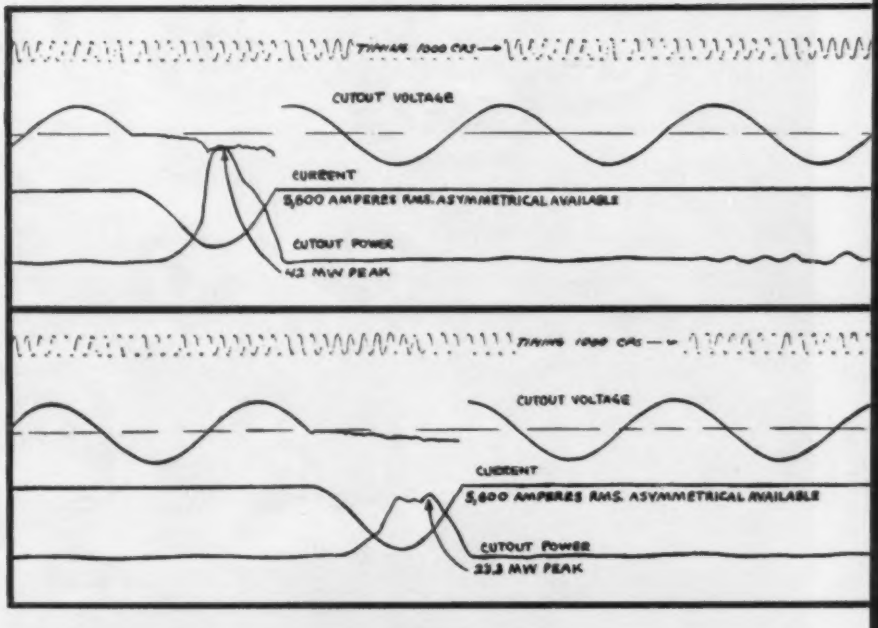


exhaust blast reducing the energy

Here's the proof:

This pair of oscillograms shows how "arc-shortening" reduces the arc energy. The upper oscillogram is taken from a test on an XS Cutout *without* an arc-shortening rod; the lower is *with* an arc-shortening rod. Note that the peak power—a measure of blast violence—is virtually cut in half, from 42 megawatts without the arc-shortening rod to 23.3 megawatts with the rod. But the available fault current being handled by the arc-shortening rod is exactly the same, 5600 amps rms asymmetrical. Note also that the maximum arc voltage has been reduced 50%. This is indirectly a measure of the reduced power in the arc.

For additional information: S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.



S&C

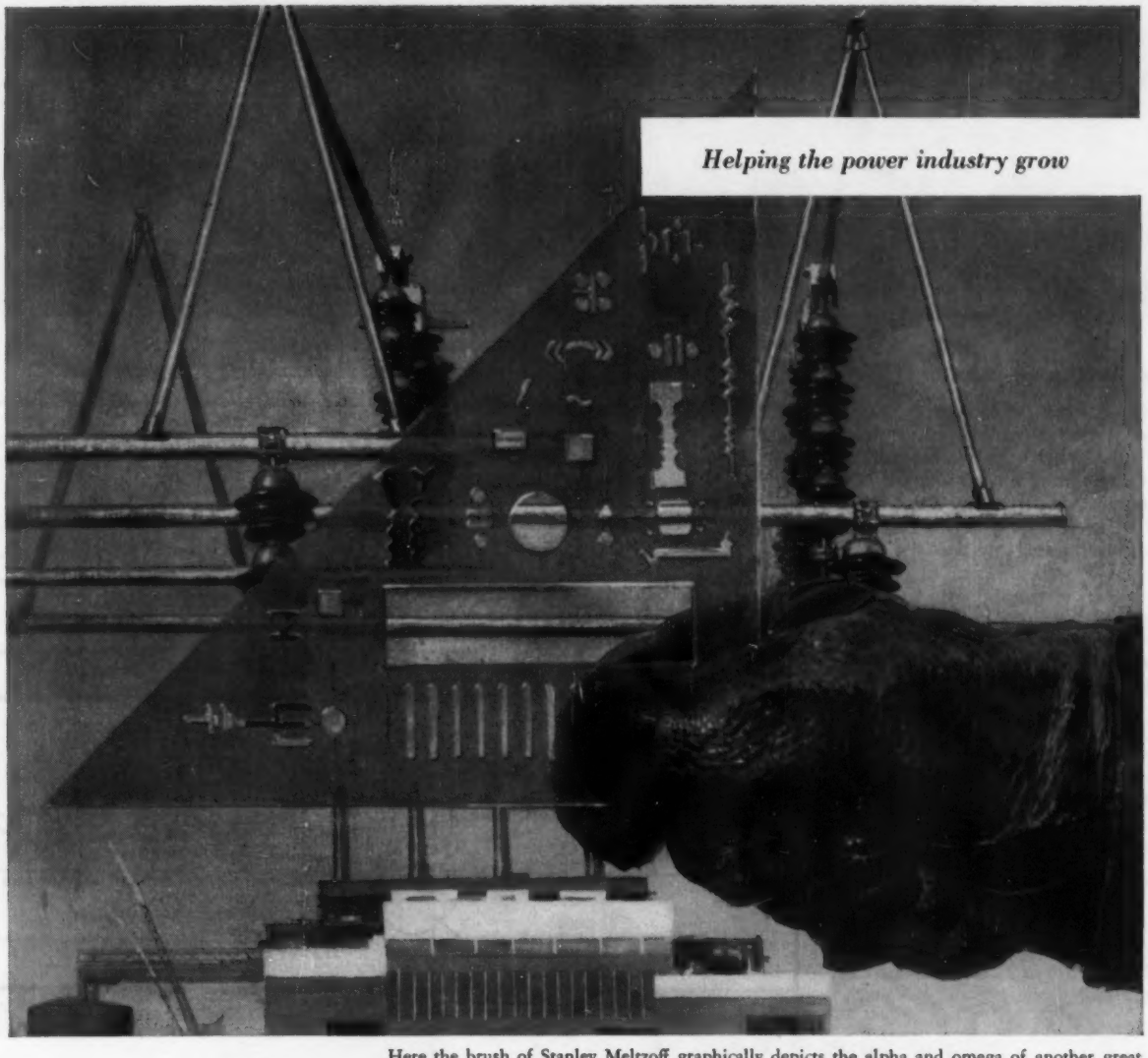
For voltages through 4.8 kv

POSITECT CUTOUTS

Enclosed cutouts with full load switching capability

The S&C Positect is the only enclosed cutout with full load switching capability, without external arc or exposed hot parts. Will switch up to 300 amperes with disconnect tube. Note interrupter attachment which permits full load switching. Designed and tested for closing against faults. In case of fault closing, all blast is directed away from operator.

Specialists in High-Voltage Circuit Interruption Since 1910



Here the brush of Stanley Meltzoff graphically depicts the alpha and omega of another great power project—the intricate installation nearing completion, the gloved hand of a skilled craftsman grasping the template used by the engineer and draftsman in translating the design.

Control Costs in Construction

Regardless of the size and complexity of a project, cost control is invariably an important factor in its design and construction. Our experienced teams have proved over and over their ability to complete projects on schedule and within established budget limits. We offer a broad, flexible range of services—and facilities that can be adapted to moderate or extensive needs.

We have worked with many well-known utilities and industrial firms in designing and constructing hydroelectric and thermal plants, electric substations, and installations for supplying heating and process steam.

Let the skills and creative abilities of United Engineers augment the engineering staff of your own organization. We invite you to share and profit from our background of more than 70 years' experience.

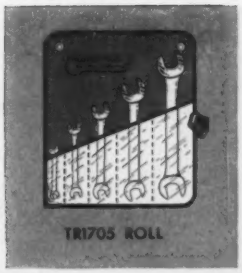
UNITED ENGINEERS

& Constructors Inc

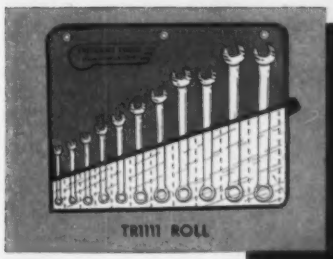
U.E.&C. (Canada) Ltd.

Designers • Constructors • Consulting Engineers

New York • PHILADELPHIA • Chicago



CRESCENT OPEN END AND BOX WRENCHES



SOLD SINGLY OR IN SETS

Seven kit assortments available in convenient rolls—four in handy pouches. Clear plastic fronts permit quick selection of proper wrench size.

Crescent Open End and Box Wrenches are drop-forged from special analysis alloy steel, precision machined to insure accurate opening sizes, and handsomely finished in chromium plate. These fine wrenches provide world famous Crescent quality at popular prices. Open End Wrenches are available in 13 sizes from 1/4"—5/16" to 1-1/8"—1-1/4"; Combination Wrenches in 14 sizes from 3/8" to 1-1/4"; and Double Offset Box Wrenches in 9 sizes from 3/8"—7/16" to 7/8"—1-1/16".

Sold by Hardware Dealers everywhere.

CRESCENT TOOLS
Give Wings to Work
Sign of the Artisan
Symbol of Excellence

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

PEPCo Erecting 55 Miles of Steel Towers for 230-kv Line

District of Columbia utility building plant, transmission line, as capital's power needs rise

In July, 1957, ground was broken for Potomac Electric Power Company's new generating station near Dickerson, Maryland. On that occasion PEPCo President R. Roy Dunn made this statement: "The ever-increasing use of electricity by our existing and new customers requires us to proceed at once with this new generating station. Our peak load has increased about 50% during the last five years and this summer we have already exceeded last year's peak by 12%, or 102,000 kilowatts."

350-MW PLANT . . . The Dickerson plant, the company's fourth generating station is now well under way. Bethlehem fabricated approximately 6500 tons of steel for the structure and lost no time in erecting the massive framework. The PEPCo timetable calls for the first of the two 175-mw generating units to begin operation in June, 1959, and the second in the Spring of 1960.

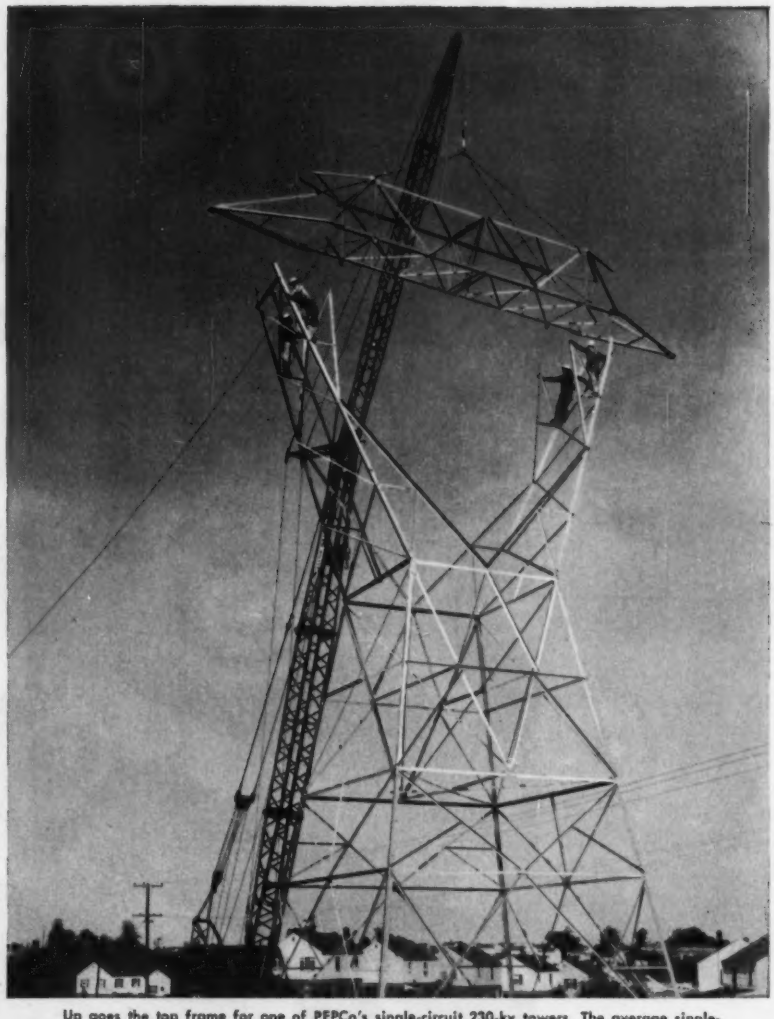
55 MILES OF TOWERS . . . Electric power from Dickerson will be transmitted to load centers in and around the capital on approximately 580 galvanized steel towers, totalling nearly 6000 tons. Some are single-, some double-circuit, each supplied in four types and with variable leg extensions. All towers were designed to standard loadings and for maximum spans of 1200 ft.

Bethlehem is also fabricating about 225 tons of switchyard structures to be installed at the Dickerson plant.

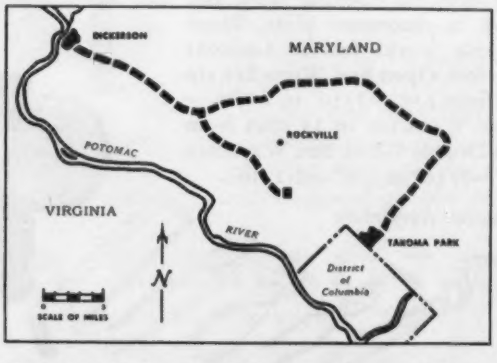
FABRICATED AT LEETSDALE . . . The towers and switchyard structures for this project are being detailed, fabricated, and galvanized at our tower shop in Leetsdale, Pa., near Pittsburgh. Design was handled by our engineering staff.

West Coast requirements are fabricated at Bethlehem Pacific shops in South San Francisco, Calif., and Seattle, Washington.

May we quote on your requirements? Please contact the Bethlehem sales office nearest you.



Up goes the top frame for one of PEPCo's single-circuit 230-kv towers. The average single-circuit tower stands 87 ft, weighs 6½ tons; double-circuit towers average 124 ft and 10 tons.



A 55-mi steel tower line will transmit power from the Dickerson Generating Station into PEPCo's service area.

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On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

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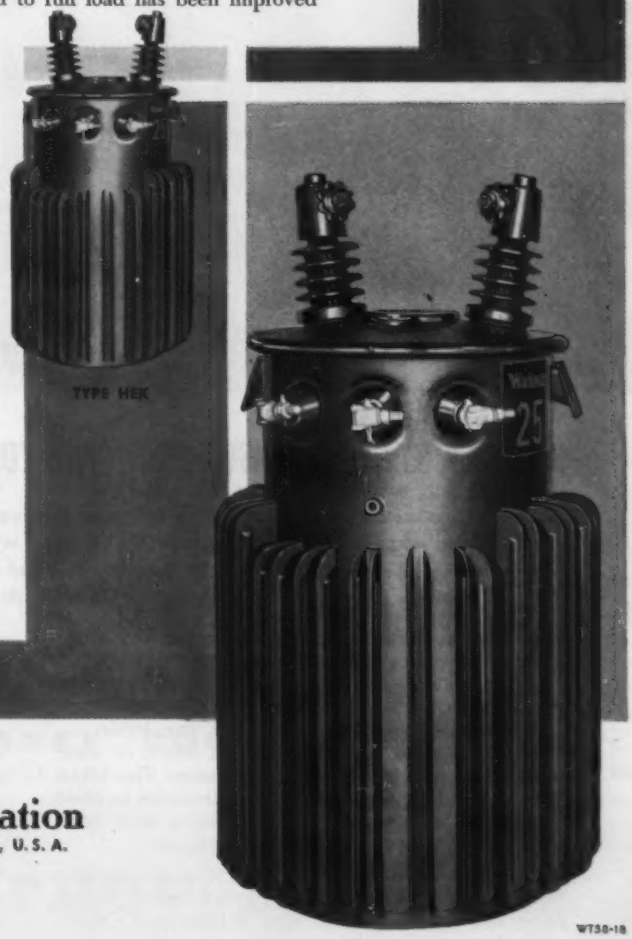
- LOWER IMPEDANCE
- BETTER REGULATION

Wagner's engineering research and development departments are working at full speed to bring you greater values. The Wagner line of single phase pole-type distribution transformers has been redesigned to give you more efficient, longer lived units for your loads of today and tomorrow. Lower exciting current and lower impedance values have been achieved. The percentage of voltage drop from no load to full load has been improved for better regulation.

GUARANTEED LOSSES REDUCED—Wagner's published electrical performance sheets for a 25 Kva, 7200 volt transformer show that guaranteed core losses have been cut approximately 12 per cent... total losses cut approximately 5 per cent. Other Kva and voltage ratings have correspondingly-improved loss ratios.

SMALLER SIZE—The size of these redesigned transformers has been substantially reduced. The 25 Kva Type HEK Transformer, for example, is now only 37 inches high, including the cover-mounted bushings... a reduction of almost 10 inches in height.

Choose these improved Wagner Form W Transformers for your lines—ask your Wagner Sales Engineer for the full story. There's a Wagner Branch in every principal city.



LIVE BETTER ELECTRICALLY

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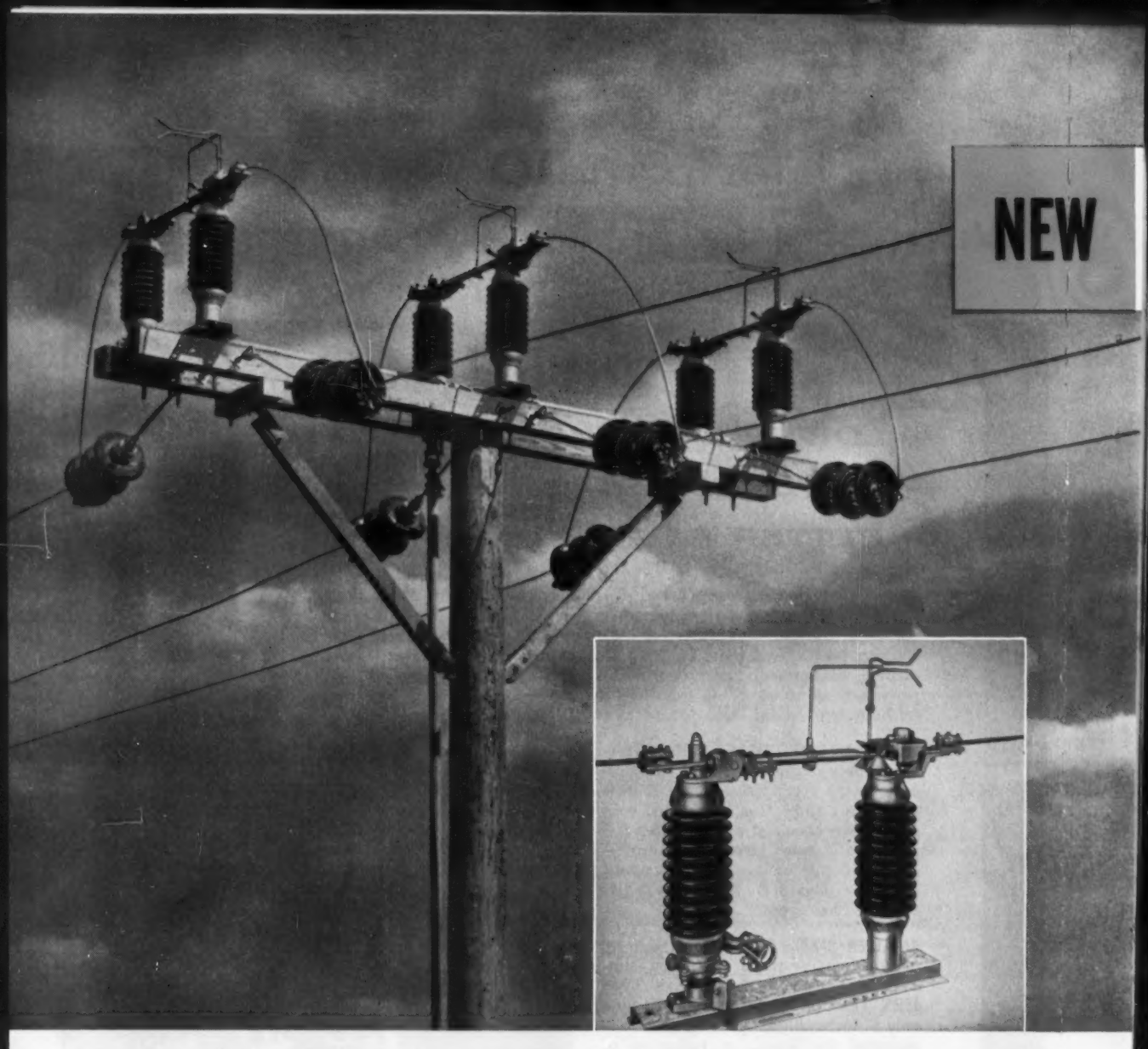
WT58-18



NO OTHER SIDE-BREAK DISCONNECT GIVES YOU ALL OF THESE OPERATING ADVANTAGES

- **Correct contact always maintained at blade tip even if crossarm warpage distorts the switch base.**
- **All blades engage fully in the break-contact jaws without precise adjustment of the inter-phase rods.**
- **Less time and labor to install with Kearney original wide-tolerance mechanical design.**
- **Easiest, surest ice-breaking ability available on both opening and closing.**

This newest Kearney development solves long-existing operating problems of crossarm mounted group operated side-break disconnects. The best supporting structure or crossarm construction may . . . due to ice loads, age, wind or line strain . . . deflect enough to distort the switch bases, or alter the relative positions of the three phases. This often causes loss of contact or failure of all blades to close completely in conventional disconnects with both rigid blades and stationary break-contacts.

Kearney's advanced design features a self-aligning blade constructed to permit controlled vertical movement and axial rotation. This automatically compensates for base distortion . . . keeps the blade tip correctly aligned in the contacts. The break-contact swings 30-degrees with the blade as it is opened or closed, producing high leverage ice-breaking ability and full wiping of the silver current transfer surfaces. On closing, the blade tip fully engages the break-contact before the contact moves from its angular open position, compensating for any shift in position of the switch bases. This same feature also allows considerable freedom in interphase rod adjustment, enabling Kearney *Self-Aligning* side-break switches to be installed faster and more economically than other types.

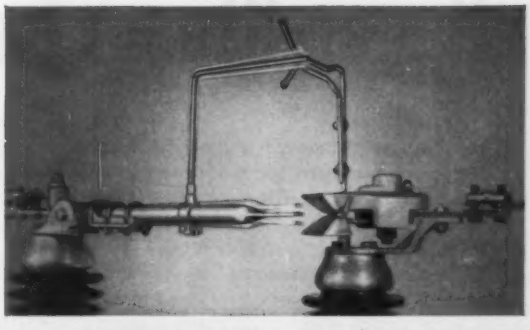
The details of these original features for maintenance-and-adjustment-free operation are shown on the facing page.

Kearney's

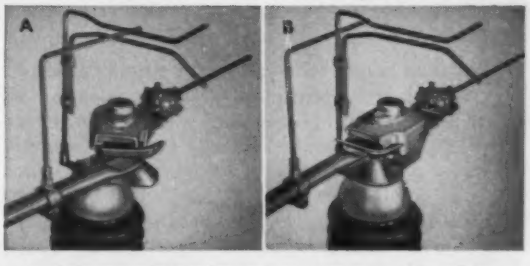
Self-Aligning SIDE-BREAK DISCONNECTS

...always make positive contact, even if the supporting structure warps, twists, bows or settles.

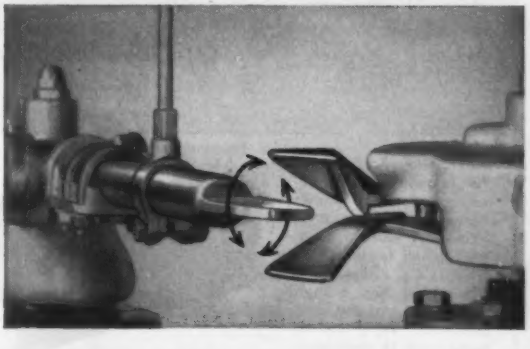
Self-aligning blade moves in a vertical plane to re-establish the original relationship between blade tip and contacts if supporting structure warpage distorts switch base. Wide mouth contact jaws assure blade entry into the contacts. Vertical 1¼" movement more than corrects for extreme cases of misalignment.



Break-contact swings 30° in the plane of blade travel as switch is opened or closed, providing highest leverage ice-breaking and full wiping of the current transfer surfaces. Note that the blade tip is fully engaged, and full contact is maintained (A) through the final 20° of blade travel to the fully closed position shown at (B). This feature allows more latitude in phase rod adjustment than other designs.



Blade rotates 12° on its longitudinal axis. If base distortion has affected blade-contact alignment, the blade tip will rotate as it enters the break-contact to keep all contact surfaces parallel, automatically restoring contact alignment. Friction reducing construction at all rotation points minimizes operating effort.



Switch carries full-rated load current well within NEMA temperature rise, from a fully closed position to 20° partially open position. Ratings available, 7.5 through 69 kv, 600 amperes. Equipped with conventional or whip-type arcing horns... torsional or spade-type operating mechanism. May be mounted horizontally, vertically, or underhung.

For full details talk to your Kearney representative, or write direct for Bulletin 8B.

JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue, St. Louis 10, Missouri

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FOR BETTER CONSTRUCTION... SAFER MAINTENANCE

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Plants at: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH & CLARINDA, IOWA • GUELPH, ONTARIO, CANADA

Turbines operate closer to maximum efficiency with Hagan Steam Temperature Control

The closer turbines can operate to their maximum design temperature, the more efficient their operation. Hagan's steam temperature control system permits a closer approach to this optimum figure through extremely sensitive temperature measurement and the maintenance of very stable control despite narrow proportional band settings.

The chart shown is from Commonwealth Edison's Will County Station, and is typical of the results produced by this Hagan system. Utilizing Hagan's PowrAmp for amplification, the system is sensitive to temperature changes of 1°F or less. Ratio Totalizers are employed for derivative action, as controllers and for signal combining. For example, the system includes a signal from steam flow so that load changes can be anticipated.

Valves and dampers are operated by Hagan Power Positioners, which provide the necessary power, accuracy and speed to keep up with the rest of the system. The use of a suppressed scale enables the system to maintain closer control, and the high stability of the system permits fully automatic control, even under fluctuating loads.

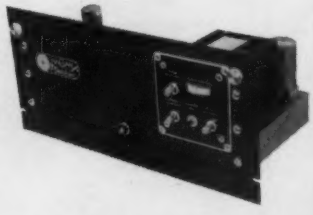
Hagan steam temperature control systems are in use on all types of boilers. Temperature control is achieved by flue gas recirculation, by various types of attemperation, by split firing, by burner tilt or by a combination of these methods. Temperature sensing and amplification may be either pneumatic or electronic, as shown below.

A Hagan engineer would be glad to explain exactly how a Hagan system can add to production efficiency. Write or phone Hagan at the address below, or the Hagan office nearest you.

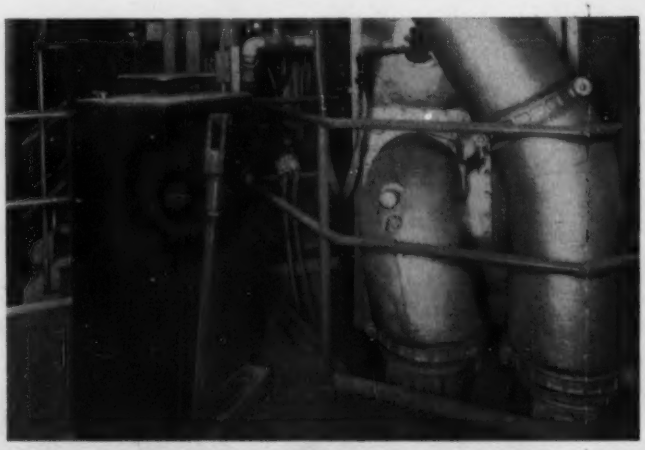
HAGAN CHEMICALS & CONTROLS, INC.

HAGAN BUILDING, PITTSBURGH 30, PENNSYLVANIA
DIVISIONS: CALGON COMPANY • HALL LABORATORIES
IN CANADA: HAGAN CORPORATION (CANADA) LIMITED, TORONTO

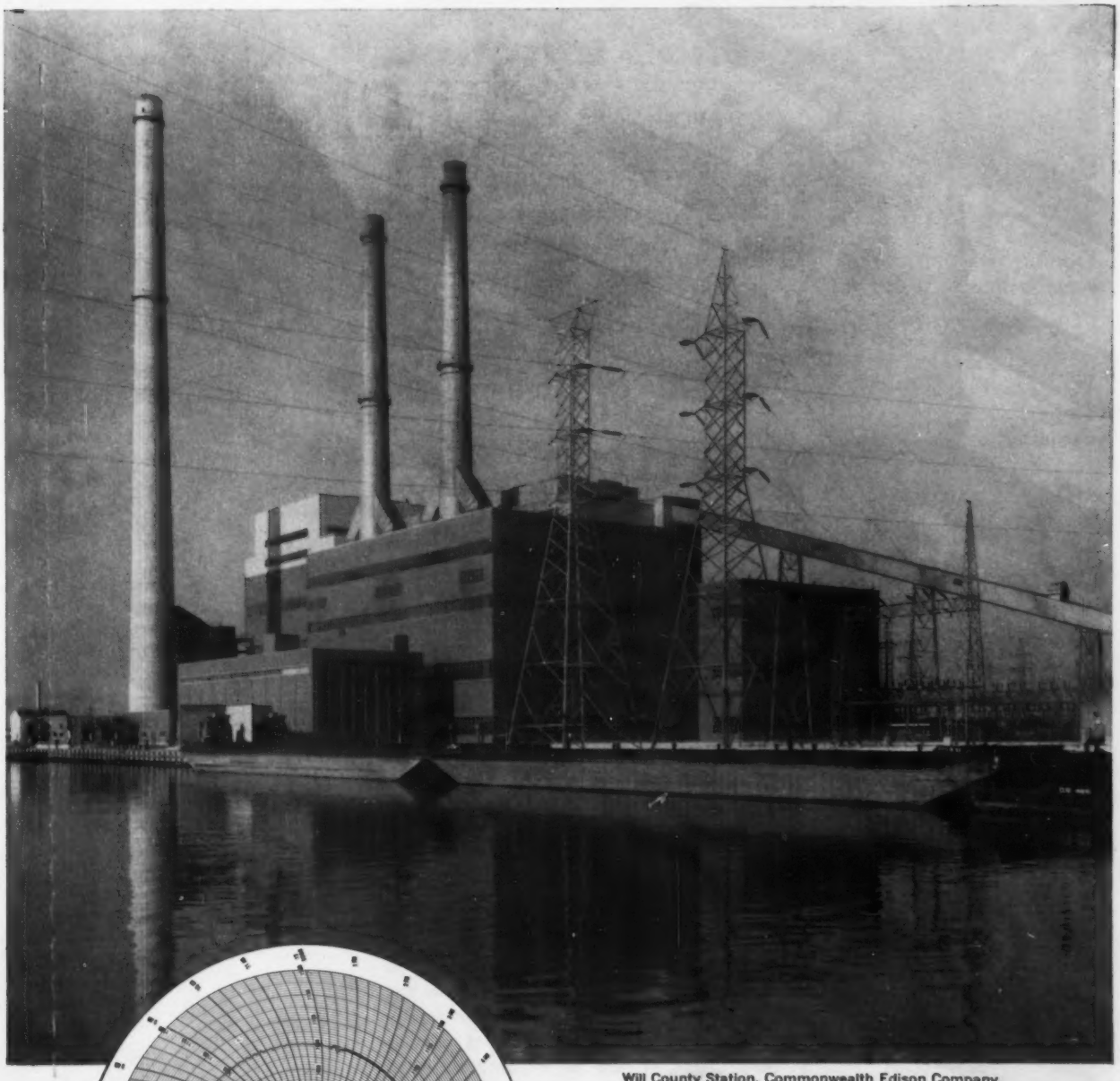
Hagan PowrAmp Amplifier is used with thermocouples for high speed response and ± 0.25% accuracy. Sensitive to very small temperature changes, PowrAmp equipment has a high degree of stability, and permits very close approach to optimum operating temperatures.



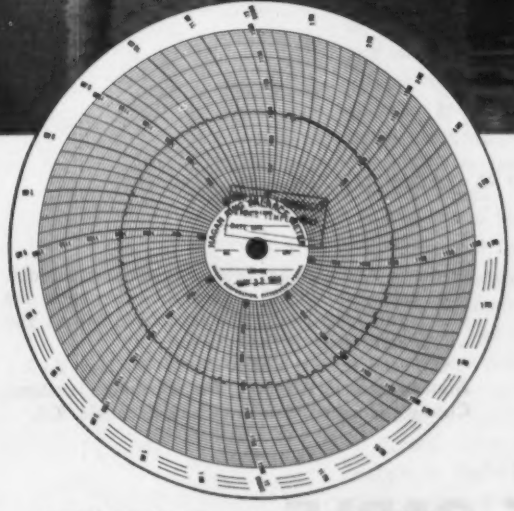
Hagan Pneumatic Thermostat provides practically instantaneous response to temperature changes and a high degree of accuracy. Generating a pneumatic output signal, it is suitable for measuring and controlling temperatures up to 1200°F at static pressures up to 2400 psig.



Hagan 8 x 14 Power Positioner controlling burner tilt. Precise and rapid response to control signals provides maximum possible regulation of superheat temperatures, reducing need for attemperation.



Will County Station, Commonwealth Edison Company, has Hagan Steam Temperature Control on Unit No. 3.



Typical superheat steam temperature chart with Hagan control. Note that chart range is 900° to 1200°, so that maximum swing recorded is approximately 5°.

These are some of the Electric Utilities who have purchased Hagan Steam Temperature control systems for one or more units:

Arkansas Power & Light Company
Carolina Power & Light Company
Commonwealth Edison Company
Consolidated Edison Company of New York, Inc.
Detroit Edison Company
Duquesne Light Company
Missouri Public Service Company
Montaup Electric Company
Niagara Mohawk Power Corporation
Orlando Utilities Commission
Tampa Electric Company
Texas Power & Light Company

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Editorial Comment

NOVEMBER 10, 1958

Meet and Inform Your Congressman

This is no time for either shouting or crying about last Tuesday's election results. The ballots have been counted in free elections. We start from where we are—not from where we wish to be.

The task immediately ahead for utility and other business executives is to meet with the newly elected Senators and Representatives in their home states and home districts. It is a time for congratulations. But it is a time, too, to inform these congressmen-elect on local problems relating to the utility business. The effectiveness of this presentation could be extremely important in the months to come.

Don't make the mistake of writing off these winners just because they happen to belong to a particular political party, or because much of their campaign support came from a faction antagonistic to your interests. The able congressman must do his best now to represent the best interests of all his constituents. He will be able to do this only if he has full information on your own business problems and concerns.

You will be doing him a service by informing him succinctly of power issues already present, or those likely to come up in the first few months of the coming session of Congress.

Your chances of a considerate hearing will be greater if you can meet with him before he assumes his Washington duties in January.

A Word of Caution on Computer Savings

A friend of ours was caught off guard the other day. Because his problem is one that may be faced by a number of utility supervisors about this time of year, we'd like to tell you about it.

Our friend heads an engineering group that has been making computer studies in several areas. All year he has been telling his boss of the pioneering work and the enormous time savings that the computer has made possible.

Last week the boss called in our supervisor friend to discuss these computer savings. Inevitably came the question: "If the computer is saving so many man-hours, wouldn't it be wise to consider trimming the engineering staff a bit? After all, we have to capitalize on savings like this."

Now we can generally agree that computers are in many instances worth their weight in rare metal. And we can agree that they make it possible to solve problems that would have been all but impossible with the slide rule and the calculating machine. Morover we can prove conclusively that they do, in fact, offer tremendous savings of time.

But it is also necessary to put these advantages in perspective. To work out a program for solving a single problem may require weeks and even months of manhours—even though the actual machine running time may be only hours or minutes.

Before glibly boasting of computer time savings it's important to give full weight to the investment in training and programming time, the expert knowledge required, and the time and cost of "de-bugging" a completed computer program.

It is not necessary for the computer/transformer-method ratio to be 30:1 to justify use of a computer. Savings of much less than that would be welcome.

We wouldn't want to see you caught off guard at budget time.

Democratic Election Sweep Portends

Ballot box has given champions of federal power strength and political atmosphere they need for TVA, other public power laws

The Democratic election sweep means that champions of federal power and REA co-ops will be riding the heavy end of the political seesaw in the 86th Congress. As a result, investor-owned electric utilities may well face the most hostile legislative onslaught since the 1930's.

For example:

- TVA's bond-financing proposal, hotly opposed by private utilities, is greatly enhanced. This, in turn, could grease the way for creation of TVA-type power authorities in the Pacific Northwest and the Missouri Valley.
- The move to bring private financing into the REA picture is effectively dead.
- The Administration's "partnership" approach to hydro power development may become a dead letter.
- The Eisenhower Administration will have a tougher time fighting off Democratic demands for an ambitious program of federal atomic power reactor construction.

Private Power Not Panicking

This is the concensus in Washington following last week's election. But some industry spokesmen, refusing to be panicked, register a dissent. They see a chance that Democratic determination to capture the White House in 1960 will exercise a restraining influence on the party firebrands.

As one utility source puts it, "I see nothing good about the election. I think we're in for trouble. But the facts are on our side, and it's up to us to fight our battles on the issues rather than on emotion.

"One thing is obvious. The election shows that nobody is going to get anywhere now by screaming about socialism, justified or not. Those days are over."

This is another way of saying that anyone doing business with the new Congress will have to deal with a body of lawmakers whose over-all complexion is considerably more liberal than before.

The Democrats, for example, stepped up their majority in the House from 35 seats to more than 130—their biggest margin of control since the New Deal days of 1936.

In the Senate, the Democratic-Republican ratio now stands at 62 to 34.

Some of the most powerful conservative voices in the Senate have been stilled. These include such Republicans as Sens Arthur Watkins of Utah, John Bricker of Ohio, William E. Jenner of Indiana, William Knowland of California, and George W. Malone of Nevada.

The National Rural Electric Cooperative Assn claims partial credit for the congressional election results.

"The election indicates there was a lot of dissatisfaction with Administration policies," says a spokesman. "Several incumbents who have not supported our program were defeated."

Specifically, he pointed to Indiana, where Gov Harold Handley was defeated in his bid for the Senate. Handley, he recalled, was vigorously opposed to a proposed REA loan for a major generating facility.

Certainly the public power-REA co-op bloc can take considerable comfort from the individual changes in faces—particularly as these will be reflected on key committees. For example:

- There are major shakeups on both the House and Senate Interior committees, which handle legislation dealing with hydro power projects.

On the House side, ranking Republican Rep A. L. Miller of Nebraska was a surprise election casualty. The next highest GOP member, Rep John Saylor of Pennsylvania, is not considered as strong a supporter of the Administration' "partnership" approach to power development. On the other hand, the two key Demo-

Some power-influencing personalities in the new

ANDERSON

Still Chairman, Joint Committee on Atomic Energy

MILLS

Heads House tax-writing committee

CASE

Ranking Republican in western power matters

CHAVEZ

Still boss of Senate Public Works Committee

Legislative Hostility for Private Power

crats on the committee—Reps Wayne Aspinall of Colorado and Walter Rogers of Texas—are expected to support federal development.

The pattern is the same on the Senate side. Three Republicans—including ranking GOP Sen George W. Malone—fell by the wayside. Their replacements are likely to be more friendly to public power.

As a result, the Administration will be under heavy congressional pressure to make the Trinity Project all-federal, instead of letting Pacific Gas & Electric Co develop the power facilities.

In addition, an attempt is expected to resurrect controversy over the Snake River, although private development already is underway.

• The Joint Committee on Atomic Energy, under the rotation system between House and Senate, will come under the chairmanship of Sen Clinton Anderson (D-N.M.), the sharpest critic of the Administration's atomic power policies.

The Republican voice on the committee, at the same time, is greatly weakened by the departure of four GOP members—Reps James T. Patterson of Connecticut and Thomas A. Jenkins of Ohio, and Sens William F. Knowland of California and John Bricker of Ohio.

Newcomers to this committee are handicapped, at best, by their ignorance of atomic matters. In addition, as one public power spokesman puts it, "We can't lose. The new members may be more friendly to federal reactors than Bricker and Knowland."

• The House and Senate Public Works committees, which handle TVA legislation, remain in the control of pro-public power Democrats. Conservative strength, on the other hand, is likely to be even furthered as victorious Democrats are given some of the seats now held by Republicans.

Thus, quick approval is expected for the proposal to authorize TVA to issue revenue bonds to finance its own expansion.

The U. S. Chamber of Commerce, for one, fears this in turn will lead to creation of valley-type authorities in both the Columbia and Missouri River basins.

The first step, its spokesmen feel, might be creation of a Missouri Valley Power Pool which could be tied in with the Northwest Power Pool.

Certainly Sen Richard Neuberger's proposal to create a Columbia River Development Corp has gained important new strength—although there's some doubt he is ready to make a final push.

Much of the dark outlook, from the standpoint of private power, is based on the assumption that the Democratic leaders in Congress will be forced to move leftward from their middle-of-the-road course.

The thinking goes that Speaker Rayburn and Senate Majority Leader Lyndon Johnson will be unable to sell their philosophy of "responsible opposition" in a Congress where Democrats are overwhelmingly in control.

Northern liberals long have chafed at the moderate Texans' hesitation to take a sharp offensive. Now, Johnson and Rayburn will have no choice, according to this view.

In fact, you even hear speculation that Johnson will find it necessary to step down from the leadership in order to avoid jeopardizing his re-election from conservative Texas in 1960.

Democrats May Use Moderation

However, private utility spokesmen caution that there is another side to the coin—that there are forces which may influence the new Congress to be less hostile to business than expected.

"The Johnson-Rayburn policy certainly appears to have paid off," says one source. "After all, the Democrats swamped the Republicans. We shouldn't forget that the Democrats' big aim now is to win the Presidential election in 1960.

"With such a huge majority, they certainly must take the responsibility before the voters for what Congress does in the next two years. I expect them to tread carefully to avoid setting off a reaction against the party in 1960.

"In addition, remember that not all Democrats favor public over private power. For example, we see no reason to fear the new Senators from West Virginia and Connecticut."

Another industry source expressed this view:

"Whenever you have a big liberal bloc in Congress, you usually find Southern Democrats and Republicans joining together in a coalition. I expect to see that now."

But the coalition that has worked since 1939 has been trimmed by the last three elections so that it will be a minority, in fact, in the 86th Congress.

Neutral observers, although convinced that faith in a coalition is mis-placed, think the utility spokesman's final point is likely to prove more prophetic:

"President Eisenhower knows he will not run again. Now, more than ever, he will feel free to veto what he considers bad legislation. That will be the most effective barrier of all to big spending programs."

Democratically-controlled 86th Congress

CANNON

Continues holding Federal power purse strings

ROGERS

Takes over House Interior Subcommittee

GE Unveils Two-Pronged Program

A proposal that electric utility industry invest $111 million in a unique accelerated program of atomic power development leading to commercially competitive nuclear power in seven years has been advanced by General Electric Co. The plan has as its primary objective to put utilities in the U. S. in the market first with atomic power at prices economically competitive with fossil fuel plants by 1965.

The GE proposal calls for simultaneous execution of two parallel programs. One, known as "Operation Sunrise," provides for an accelerated test and development program leading to perfection of large-scale nuclear power plants in the shortest possible time. The other, known as "Operation Know-How," contemplates accelerated field installation of small-scale packaged atomic power plants to provide needed experience and training in the operation of atomic power stations.

The entire program, as conceived and presented to the power industry by GE's Atomic Products Div. under direction of Vice President Francis McCune, calls for the concentration of research and development effort on a single reactor. While recognizing that there are many other feasible reactor types, proponents of the GE proposal recommended that the Boiling Water Reactor (BWR) be selected as the one having the greatest promise for these reasons:

- *The technical foundation of BWR has been established by operation of five "first generation" reactors.*
- *Safety of BWR has been proved by AEC test.*
- *Low enrichment, uranium oxide fuels have been proved feasible for commercial service.*
- *It offers the lowest capital cost.*
- *It is best reactor for immediate exploitation.*

OPERATION SUNRISE

Operation Sunrise would concentrate on the development, in depth, of boiling water reactor power plants and the development program would be carried out in three stages:

1. By 1962 design and start construction of five developmental BWR plants of 25 to 100-Mw capacity.

2. By 1965 complete design and construction of three evolutionary plants of 100 to 325-Mw capacity based on developmental experience and capable of producing energy at a cost of under 8½ mills.

3. By 1970 perfect and build target plants of possibly 450 Mw costing $175 to $225 per kw producing energy at cost of 6.5 mills per kwhr. Such plants could be competitive with 25% of conventional plants then being installed.

Keys to attaining these objectives as seen by GE are:

Increased power density—a doubling of power output from a given reactor core volume.

Reduction in plant complexity—simplification of steam supply system, compaction of plant layout and reduction of containment cost.

Better steam conditions—to improve thermal efficiency.

Increased plant size.

Improved fuel performance.

These keys suggest that attainment of competitive atomic power can be realized under Operation Sunrise in four steps.

First, construction of first generation boiling water reactor plants of the type now existing or under construction at Vallecitos, Argonne National Laboratory and Dresden Nuclear Power Station.

Secondly, design and construct a series of developmental plants. Five possible plants are:

- A 50-Mw natural circulation plant to provide the basis for developing plants of extreme simplicity and low cost in the range of ten to 150 Mw. Since the Humboldt Bay plant of Pacific G&E is already committed, and is of this type, only four developmental plants remain.
- A 25-Mw "compact" plant directed toward attaining the design and construction simplicity for forced circulation plants in the range of 75 to 300 Mw.
- A 25-Mw high-power density plant to test the technical objective of at least doubling the steam output from a given reactor core.
- A 100-Mw high-power density plant extending the results of the preceding plant. It will test the limits of power density that can be obtained in a medium-sized reactor. This plant could be 250 Mw.
- A 50-Mw separate nuclear superheater that could be "hooked on" to a BW plant and to test ability to improve thermal efficiency.

Third, design and construction of medium and large scale evolutionary plants based on experience gained with the series of developmental plants. Three possible evolutionary plants are these:

- A 100-Mw natural circulation plant with internal circulation and internal steam separation to show the upper limit of rating for a self-contained natural circulation system.
- A 200-Mw forced circulation single-cycle plant with close-coupled recirculation loops, high power density in a large cores, and high pressure saturated steam.
- A 325-Mw plant with boiler-superheater combination—to furnish experience with superheating reactor of economic size. Typical steam conditions will be 900 F and 915 psi; heat rate: 9,500 Btu per kwhr.

These three evolutionary plants will demonstrate fuel costs in the range of 2 to 2½ mills per kwhr. Their total power cost will be under 8½ mills per kwhr, making them economically competitive in selected locations with fossil fueled plants going into service during the 1960's.

for Competitive A-Power by 1965

Fourth, design and construct target plants showing better cost because of increased unit rating and accumulated experience. One possible target plant would be a 450-Mw high density separate superheater plant costing an estimated $175 to $225 per kw and have production costs of 6½ mills per kwhr.

Proponents of the GE program estimate its gross cost at $128 million. Of this amount they contemplate that roughly $90 million would be absorbed in the construction of four developmental plants and an additional $38 million in research and developmental costs. However, it was pointed out to the industry that $10 million of the $38 million R&D cost would be defrayed by utilizing results of government research. And an additional $7 million will be absorbed by GE, leaving $111 million to be supplied by the electric utility industry.

GE contends that with Operation Sunrise, modern nuclear plants will be available which will be competitive with 25% of the conventional plants then being installed.

OPERATION SUNRISE—Developmental Plant Types

Type and Nominal Rating	Ratings Available	Start of Detail Design	Start Operation
1. 50 Mw Natural Circulation	50-60 Mw	1959	1962
2. 25 Mw Compact	5-25 Mw	1959	1961
3. 25 Mw High Power Density	5-50 Mw	1959	1961
4. 100 Mw High Power Density	100-250 Mw	1962	1965
5. 50 Mw Separate Superheater	10-100 Mw	1960	1963

OPERATION KNOW-HOW

Operation Know How, second phase of GE's program to put electric companies in the nuclear power business on a competitive basis, proposes that utilities buy and build up to 50 5-Mw packaged type BWR plants and use them to accumulate field experience and train operating personnel.

These packaged plants, GE points out, while not concerned with the attainment of low cost per kwhr, would use safe, proven equipment now available and would cost $4 to $4½ million. These plants, to be available for delivery in 1960, in addition to providing means of capitalizing on public interest in atomic power, would contribute to the solution of a number of contingent problems related to large scale atomic power production. Among them:

1. Introduce atomic power to the nation on a wide scale in minimum time at minimum cost.

2. Train utility operating personnel.

3. Establish working insurance relationships.

4. Develop public understanding of atomic power and thus establish power company's role in its production and development.

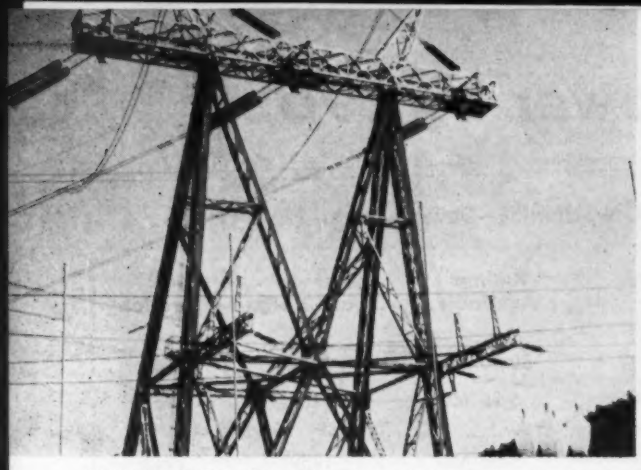
5. Improve investor relations.

6. Provide field facilities for testing fuel types, waste disposal methods and other related matters.

7. Advance utility relations with regulatory agencies.

OPERATION KNOW-HOW—Power Plant Data (Estimated)

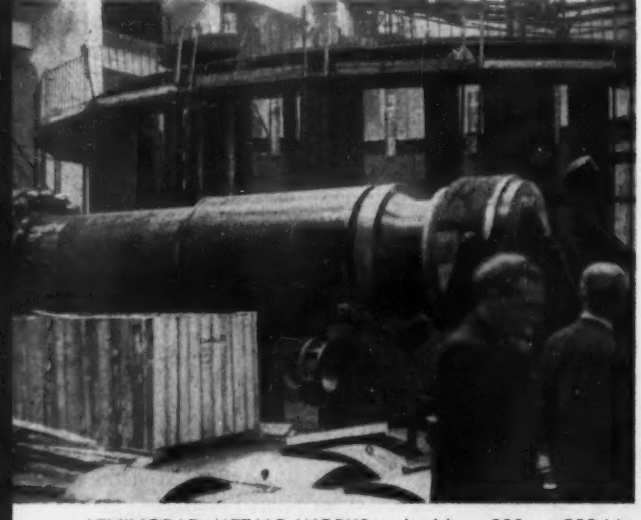
Power Output	
Gross Electrical Output, kw	5,000
Reactor Power, kw	21,800
Gross Plant Heat Rate, BTU/KW-HR	14,800
Reactor Data	
Type	Boiling Water
Mode of Reactor Flow Circulation	Natural Convection
Steam Flow, Lbs/hr	66,400
Reactor Pressure, psig	650
Temperature—F	497
Fuel	
Fuel Material	Enriched
Design Irradiation Level, MWD/T	5,000
Initial Enrichment, %	2.7
Refueling Cycle, Months	6



EHV EMPHASIS, dictated by long distances from hydro sites to load centers, now finds 1,110 miles of 400 kv operating

THREE BANKS of 400/100-kv transformers, each with 250 Mva capacity, supply power from Noginsk substation

POLICY SHIFT will bring construction of more thermal plants instead of hydro stations like 2,300-Mw capacity Kuibyshev



LENINGRAD METALS WORKS is building 200 to 300-Mw units, including turbines for Stalingrad hydro station

EEI Reports

U. S. delegation finds Soviet power industry one of fastest growing in the world despite some snags in meeting goals

"In 1957 some 209.5-billion kwhr of electric energy were generated in the Soviet Union. While this is far below the 715.7-billion kwhr (including industrial) generated in the U. S. last year, it is an indication that, in total production, the Soviet power industry is one of the largest and one of the fastest growing in the world."

This is the first general view of the U.S.S.R.'s power picture by ten top U. S. electric industry men* who covered 5,000 miles of European Russia in 16 days last August. Despite the emphasis on electrification, however, "the Russians will admit that the requirements of their national economy have not been met and that power developments in the Soviet Union lag behind those abroad," says the forthcoming report of the tour being published by Edison Electric Institute. The trip was under the auspices of EEI and the Association of Edison Illuminating Companies. It was arranged with the State Department and its U.S.S.R. counterpart.

There are 52 power systems in all of the U.S.S.R., many of them individual plants, the report says. In European Russia three principal interconnected systems have capacities of 6,000 to 7,000 Mw each. Plans call for a link between these three networks and other European Russian systems and six Central Siberia systems. This single-grid idea is "one of the big headaches"

---

* Harvey E. Bumgardner, assistant to president, Detroit Edison Co and chairman, Technical Assistance to Overseas Visitors Committee, EEI; Walker L. Cisler, president, Detroit Edison; J. F. Davenport, executive vp, Southern California Edison Co; Donald S. Kennedy, president, Oklahoma Gas & Electric Co.; Elmer L. Lindseth, president, Cleveland Electric Illuminating Co; Gwilym A. Price, board chairman, Westinghouse Electric Corp; Philip D. Reed, chairman, Finance Committee, General Electric Co; Roy G. Rincliffe, president, Philadelphia Electric Co; Joseph L. Singleton, executive vice president, Allis-Chalmers Mfg Co; Edwin Vennard, vp and managing director, EEI.

DISPATCHING CENTER in Moscow area was one of first stops by U. S. delegation in its tour of European Russia

ATOM PLANT visit brings together, l to r, Soviet's Dr A. K. Krassin, Walker Cisler, Detroit Ed, and Elmer Lindseth, CEI

on U. S. S. R.'s Power Picture

now, the American delegation was informed.

The Soviets intend to add 60,000 Mw of capacity in the U.S.S.R. by 1965. This goal, if reached, would bring total capacity to about 108,000 Mw. Some 85% of the new plants will be thermal, the friendly and courteous Soviet engineers told the U. S. group.

Preoccupation with new industrial development is reflected in the disclosure that about 80% of the Soviet power output is devoted to industry and construction. Some 16% goes for rural and residential use.

Standard size of new steam generating plants in the U.S.S.R. is 600 Mw. Stations are being planned, however, for as much as 1,200 Mw. Units of 200 Mw were being manufactured by early 1958, the report says, to operate at 3,530 psi and 1,075F. Single-shaft units of 400 and 450 Mw and double-shaft units of 600 Mw are being designed. Also on the drawing boards is a design for a block-boiler turbine of 300-Mw for steam at 4,410 psi and 1,200F.

Hydro De-emphasizing Begun

Although the U.S.S.R.'s hydro potential is more than 300,000 Mw, a shift in policy to construction of more thermal stations is under way, according to Nikita Khrushchev. He is reported to have said at the dedication of the Kuibyshev station in September there would be a de-emphasis of hydro construction. The 3.7-mile-long Kuibyshev dam has 20 units, each with a 105-Mw rating and operating capacity of 115 Mw. The spillway is 0.6 miles long and in addition there is a water bypass under each turbine. The turbines were described as the largest Kaplan units in the world, weighing 3,400 tons on the bearing. Control is entirely automatic.

It wasn't until the delegates reached Geneva that they learned the Soviet Union had put into service a 100-Mw nuclear power plant. The first of six such units to be built at a new Siberian city, the facility will produce power for industrialization of the area. A 5-Mw plant in Obninsk with a pressurized-water graphite-moderated reactor was the "world's first atomic power plant," the visitors were told. It began operating in 1954.

Presently under construction are four nuclear stations of 50, 240, 250 and 420-Mw capacity. Most of these and future plants will be equipped with reactors using ordinary water as coolant. During the next seven years atomic power is expected to play only a small part in the growth of electrical output, the report notes.

The long distances from chief industrial centers to hydro sites probably best explains the U.S.S.R.'s emphasis on high-voltage transmission. About 1,110 miles of 400-kv lines are now in operation. Next year these will be converted to 500 kv, the U. S. group learned. Direct current transmission will enable the development of the country's single power grid, her engineers believe. Completion date is 1962 for an 800-kv dc line from Stanlingrad to the Don Basin—a distance of about 300 miles.

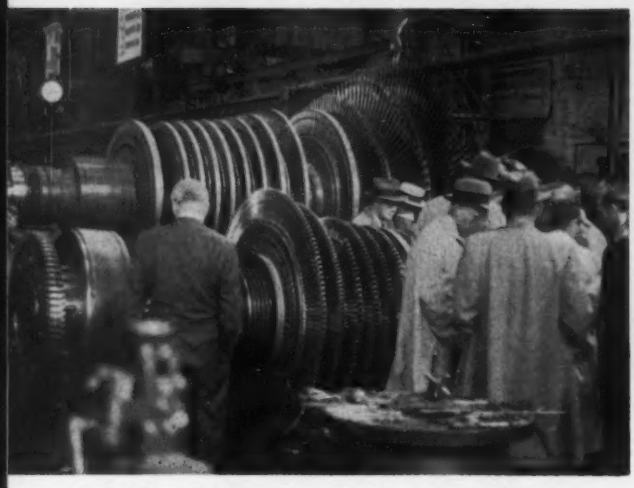
Lines of 35 kv and higher totaled some 62,140 miles at the end of 1957. This included about 1,110 miles of 400 kv and 5,160 miles of 220 kv. In the U. S., total length of lines 35 kv and above was 245,000 miles.

One of the most modern steam plants visited by the American group was Suvorov station, about a two-hour drive from Moscow. Plant construction began there in 1952 on a site adjacent to brown coal deposits.

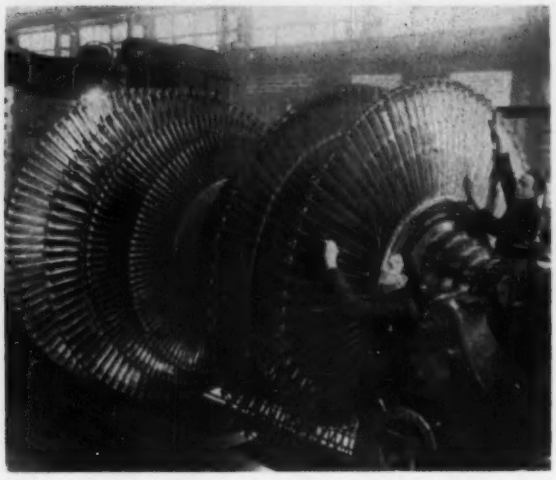
"The coal is so poor that it cannot be shipped economically," the report says. As mined the heat value is about 4,000 Btu/lb. Ash content is as high as 40% on a dry basis; 30% with moisture added.

Three 150-Mw single-shaft turbines have been installed and a fourth is under construction. Each unit has two boilers supplying steam at 2,490 psi at the outlet and 2,630 psi at the drum. Steam temperature recently was raised to 1,060F and 1,110F is their next target. Stainless steel piping appears to be giving trouble, the U. S. contingent observed.

Turbines have one stage of reheat to about 980F. Operating capacity of each unit is about 10% above rated capacity. Maximum efficiency is at 80% to 100% load. Turbine high-pressure cylinder has a double cas-



FUTURE PLANS call for 600-Mw unit on two shafts with steam at 3,415 psi and 1,075F to be built in Leningrad



LOW-PRESSURE ROTOR of a 200-Mw steam turbine undergoes dynamic balancing and inspection at Metals Works

ing to reduce thickness, the EEI report says. The high-pressure turbine has eight stages; the low-pressure cylinder is double-flow with two condensers.

Steam leaves the high pressure at 645F for reheat to 980-1,000F. The generator is hydrogen cooled at 735 psi. Generator voltage is 18 kv; station service, 6 kv; and distribution, 6 kv. Power is transmitted at 110 and 220 kv. The plant employs 750 workers, 25% of them women. Largeness of the staff is due to the plant's use as a school.

Power production costs for this plant were reportedly 7.5 kopecks per kwhr (ten kopecks = 1¢) Of this, 65% goes for fuel, 20% for a 25-year amortization period, and 15% for wages, material, and maintenance.

At the Luganskaya thermal plant in the Don Basin the visitors picked up some operating tips. Boilers for the 500-Mw plant, for instance, were pre-assembled in large components at the factory and then erected. One was built in 48 days, partly at the factory, in assemblies up to railroad transport limits, then assembled into bigger units at the site. Erection time for a 100-Mw turbine was 100 days, Soviet engineers said.

Newer pole lines are hollow concrete for the system which Luganskaya help supply. Linemen climb with a sickle-like hook on each foot with a rubber pad.

The 220-kv system is overloaded, the U. S. delegates found. Icing conditions are rough in the winter and lightning is severe in the summer. Static wires have special melting equipment and are insulated from the towers with a 1.97-in. gap. Dancing conductors pose trouble, despite the use of dampers.

Seven districts comprise the system. Each district dispatches power on its own lines of 35 kv and up. A control center dispatches all the main system.

The full itinerary of the visitors is described in the EEI report. One section is devoted to a broad look at the country's power industry and includes information on technical education, union structure, management organization and economics. A second section details the data of individual installations visited.

Gains in Some Areas of Soviet Technology Underscored in U. S. Comparison

	U.S.S.R.	U.S.
Population	200,200,000	175,000,000
Area (sq mi)	8,647,000	3,022,387
Generation (kwhr)	209,500,000,000	715,700,000,000
Thermal	170,000,000,000	582,500,000,000
Hydro	39,500,000,000	133,200,000,000
Installed capacity (kw).	48,300,000	145,689,000
By 1965	108,000,000	250,000,000
Fuel Reserves		
Coal (million tons)	300,000	943,000
Natural gas (mcf)	65,695,000	238,000,000
Highest EHV operating (kv)	400	345
EHV miles of highest voltage	1,110	1,700

	U.S.S.R.	U.S.
Miles of 220 kv	5,200	20,000
Retail household price per kwhr(¢)	4	2.5
Living engineering graduates (1955)	586,000	575,000
Largest steam unit on line (kw)	150,000	325,000
Average lb of coal per kwhr	.99	.96
Largest steam unit being designed (kw)	600,000	500,000
Largest operating hydro plant capacity (kw)	2,300,000	1,954,000

Study Economic Transformer Loading

INDUSTRIAL DISTRIBUTION was subject of W. W. Trimmier, Houston Lighting & Power Co; L. C. McGee, E. I. duPont de Nemours; and J. D. Moriaty, Gulf Oil

Lawrence and Lockie tell Texas Power Distribution Conference that too much attention is given to thermal limitations

More attention should be given to economic loading of distribution transformers, R. F. Lawrence and A. M. Lockie, Westinghouse Electric Corp, told the 11th annual Power Distribution Conference at Austin, Texas, recently. The conference, sponsored by the University of Texas, attracted 350 engineers.

Lawrence and Lockie told delegates that too much attention has been paid to thermal limitations of distribution transformers. More effort is justified in the establishment of loading practices that recognize limits imposed by thermal, voltage, and economic considerations, they added.

T. L. Hatcher, Texas Power & Light Co, stated that operating experience has not substantiated the theory that wire burndowns are reduced by using bare wire. Most faults are to ground, and the shortest path for line-to-ground faults is at the pole, he explained.

Special voltage regulating transformers have been installed by duPont to serve instrumentation, said L. C. McGee. Control equipment sensitive to voltage disturbances of as little as four cycles duration prompted the installation, he said. However, special transformers are not the answer when disturbances result in a frequency drop of as much as one-tenth of a cps. Plant power supply, said McGee, must be continuous and stable if high product quality and output are to be maintained. Instrumentation appeared to be more sensitive than the processes themselves.

J. D. Moriaty of Gulf Oil Corp described a 3,000-kva mobile substation that has transformer, switchgear, and lightning arresters mounted on a trailer. It can be hauled anywhere in the refinery area. Space has been provided for setting it up adjacent to any of the refinery's substations.

Frequent motor failures, often coming in pairs and resulting in large production losses, prompted resistance grounding of 2,400-v-delta, industrial distribution system, explained R. W. Swarthout, General Electric, and R. W. Dickinson, Phelps Dodge. Grounding made possible improved relaying, and resistors reduced damage when failures occurred.

Many "annual cost" comparisons have convinced Oklahoma Gas & Electric Co of the economy of expanding distribution systems at 12.5 kv in all except the smallest communities, said C. W. Neal. H. A. Lott, Southern California Edison Co, reported that they had found that it is not economical to change existing 4 kv to other voltages. They prefer to contain the 4 kv and serve the growth at higher voltages. But Earl White, Gulf States Utilities Co, said that his company is converting 4-kv distribution to 13 kv. A schedule has been set up for steadily reducing the area served at 4 kv.

EEI Studies Capacity Plans

Most large power companies in the U.S. today base their generation planning on a minimum reserve usually between 10 to 15% of peak load. A significant number, however, are adopting probability methods, or base their planning on the loss of some multiple of their largest unit.

These and other conclusions were reached from a survey of planning practices made by the System Planning Subcommittee of the EEI Electrical System and Equipment Committee. The survey, covering 22 companies, was presented by J. J. Tesar, Cleveland Electric Illuminating Co, to the Committee last month at Charlotte, N. C.

Tesar's group found that average unit size varies with peak lead, ranging around 10% of peak for 1,500-Mw systems and 5% for systems of 2,500 Mw and over. Maximum unit size for nearly half the 22 systems surveyed exceed 10% of peak kilowatts and an equal number now have units with ratings above 8% of peak.

H. P. Seelye, consultant to EEI's Research Committee, said the pace of utility research has quickened in the past two years. Preliminary findings of a 1958 survey show 250 new projects started since the survey of two years ago. Seelye saw need for better coordination of research to avoid overlap of activities, and an expansion of the scope of research by power companies. In some instances, Seelye said, as many as 20 companies are working on simlar projects. There are about 200 projects in progress which could profitably be extended in scope.

J. H. Foote, Commonwealth As-

(Continued on page 116)

Consumers Power Explores 345-Kv

But designs 138-kv system to serve quadrupled system load and builds more stations to delimit transmission mileage

H. F. SMALL, Senior Engineer
J. M. BRAGER, Systems Operations Engineer, Consumers Power Co, Jackson, Mich.

When is a higher-voltage transmission system needed, and which higher voltage is most economical? These questions were explored by Consumers Power Co planning engineers, with the result that they came up with a design which retains 138-kv transmission for a system load of 5,300 Mw, four times that of the system when the design was developed.

But these engineering studies were extended even to eight times the prevailing load—to 10,600 Mw, as earlier studies had proved nugatory on the need for higher transmission voltage at 5,300 Mw. But when a system reaches the 10,600-Mw size, the economies from the use of larger conductors with moderate transmission voltage are exhausted. Wires get too big and too many, and transmission losses excessive, so that a system voltage higher than 138 kv is inevitable.

When this inevitability arises, the necessary voltage increase, the engineers concluded, should be as large as possible, consistent with experience in the same approximate temperature. But so far, it appears that voltages above 138 kv are used principally for moving power over distances greater than 50 miles, or for moving quantities of power in the order of 1,000 Mw, especially when the whole of that power comes on the system suddenly rather than by gradual growth. Neither of these criteria dictated 345 kv for Consumers Power.

Besides these, there are other reasons for going to higher-voltage transmission, such as, the development of a free-flowing transmission grid to permit enormous power flows in the event of an outage of a large generator or a group of generators. And higher voltage affords stronger ties, permitting reduction in generation reserves where the savings in generation may more than pay for the transmission-line cost.

Were the Consumers Power system to go from its present 138 kv to a higher transmission voltage, why did not the planning engineers give more consideration to 230, 287, or perhaps 460 kv? In selecting the best transmission for a future system, they had to think in terms of the progress made in the development of equipment for higher voltages. And the choice was further delimited when they asked themselves: "What voltage do neighboring companies plan to use?"

In a long-range study, the basic load patterns must be firmly established. Accordingly, considerable time was spent in 1954 in compiling load data for the Consumers Power system. Individual substation loads were consolidated into regional loads. The service area was divided into four operating divisions and, again, into 16 service regions for separate study. For many years, the transmission system followed the rough horseshoe pattern of the principal loads, this pattern starting at Bay City and continuing through Flint, Jackson, Battle Creek, Kalamazoo, Grand Rapids, and Muskegon.

In the study, when the total system load was doubled, trends were taken into account, such as the rapid growth in the northern area and the gradual shifting of load growth from

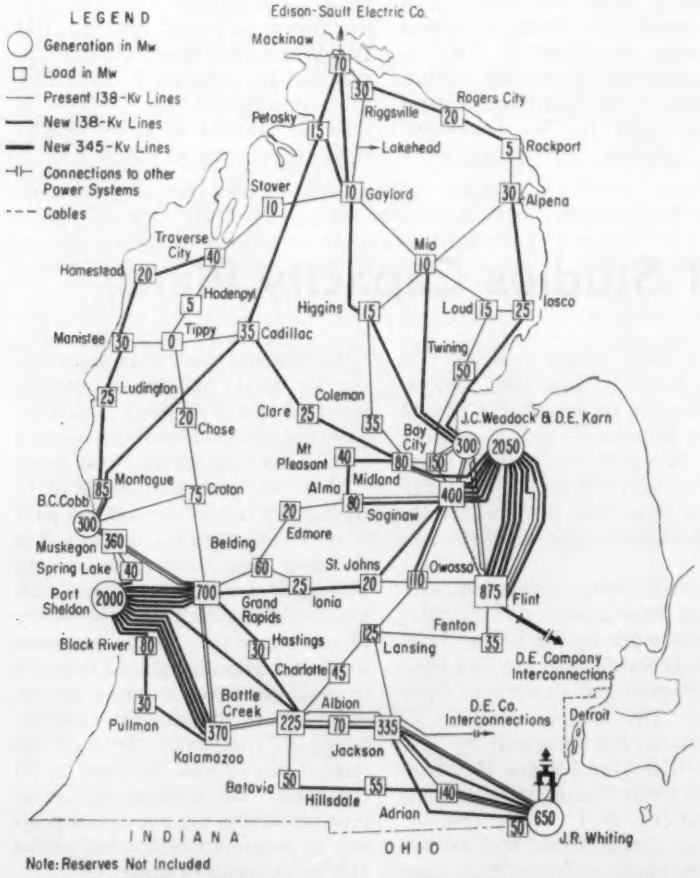


FIG 2—ALL-138-KV SYSTEM is shown schematically as it was built for load four times the present system load

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In the study, when the total system load was doubled, trends were taken into account, such as the rapid growth in the northern area and the gradual shifting of load growth from

east to west. But at quadrupled load —5,300 Mw—the effect of such trends appeared to be modified by the potentialities of the respective areas.

Consumers Power is in the lower Michigan peninsula, so that around the fringes of its territory there is a practically unlimited supply of cool fresh water. Any point in the service area is within 75 miles of such water. The planners were able to assume that coal costs would be about the same at any sites selected for new plants. Thus their system design for quadrupled load was developed on the basis that each load would be most economically served from the nearest generating source. Some 40 small plants were disregarded because they will become idle reserve, or because their outputs will disappear into the local load.

Thus the direct-to-load or least-distance principle was used for allocating loads to generation and determining the approximate load each generating plant should serve. These areas were termed "sectors." And such allocation resulted in a rough determination of plant size which was found by adding desired reserves to each sector load and deducting existing generation in the sector. For the 5,300-Mw system, the expected new plant capacities are: Karn (East) 2,000 Mw; Whiting (Southeast) 350 Mw; and, Fort Sheldon (West) 1,700 Mw.

With a 1957 system demand of 1,630 Mw, Consumers Power recently installed 156-Mw units and is now installing its first two 250-Mw generators. For these units the 138-kv transmission, with 1,431-MCM ACSR conductors, will be used.

The new system design accommodates four rather than three major plants, the newest acquisition being Fort Sheldon. This western plant's proximity to the southern load belt reduces the transmission distance for 600 Mw from 100 to about 60 miles. This shorter haul helps postpone the need for 345-kv transmission. The usefulness of the 138-kv system was further prolonged by raising the ampere abilities of conductors to take advantage of the fact that local winds almost never blow at less than 2 mph. Such winds mitigate the effect of wires warming up on hot days. This circumstance, together with increased confidence in conductor splices, prompted Consumers Power to raise the thermal ratings of lines approximately 15% above the "book" rating.

An investigation of transmission wire temperatures showed that losses based on 77F properly reflect the average ambient temperature and wind velocities in Michigan. On the Consumers system, transmission conductor sizes increased along with generator unit sizes.

The economic loading of a 138-kv line, 25 to 60 miles long, is approximately 40% of the thermal ability, but factors such as reliability and stability, must be considered. The D. E. Karn plant, with two 250-Mw units, initially requires five lines for stability. Yet the five 1,431-

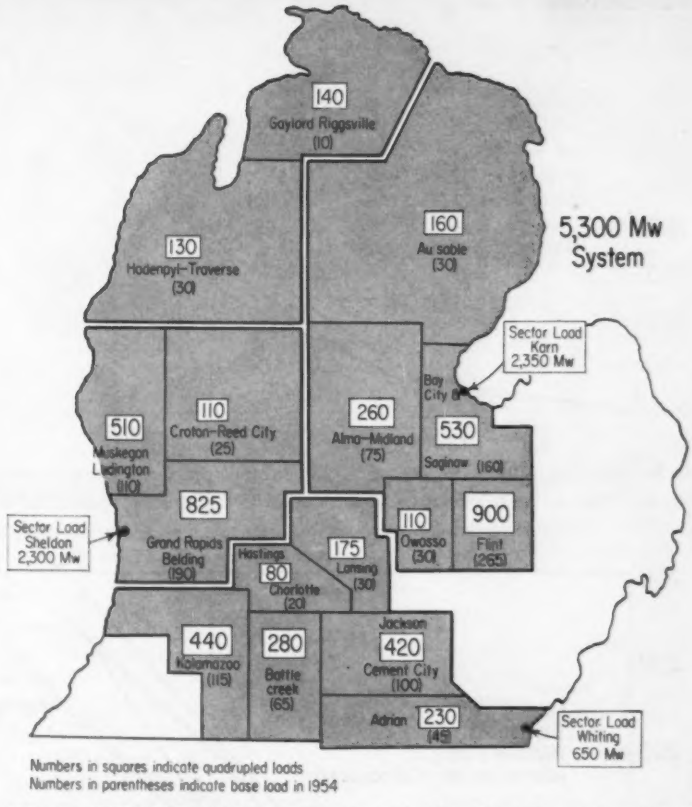


FIG 1—ESTIMATES of load pattern included consideration of local load potentialities when load is quadrupled

Comparison of 138 vs 345-kv Transmission Lines

Per Line Comparison	138 Kv	345 Kv
Voltage	138 Kv	345 Kv
Typical Wire Size	1,431 ACSR	1,414 Exp.
Thermal Ability	425 Mva	1,200 Mva
Voltage Drop Ability (In Mva Miles at 10% Drop & 98% PF Leading)	15,000	78,000
To Supply 2,000,000 kw:		
Number of lines (Approx. Equivalent)	12	4
Losses for 50 miles	3%	1.6%
Kvar Contribution for 50 miles	57,600	130,000
Right-of-way using double circuit towers	372 ft	230 ft

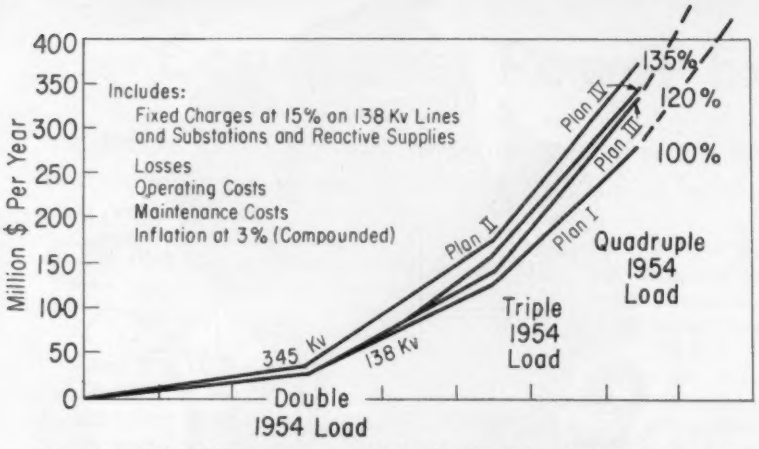


FIG 3—ANNUAL COSTS are compared for the four plans for which investment costs are given in Fig 4. For quadrupled load, 138-kv system costs are favorable

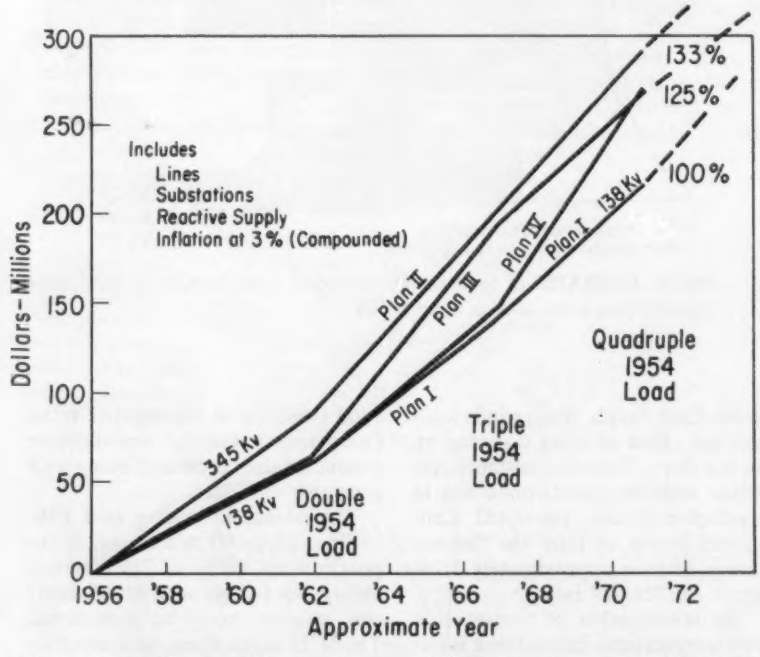


FIG 4—INVESTMENT cost for: Expansion of 138-kv through quadrupled load; all 345 kv in 1959; 345 kv for double 1954 load; and, 345 kv for triple 1954 load

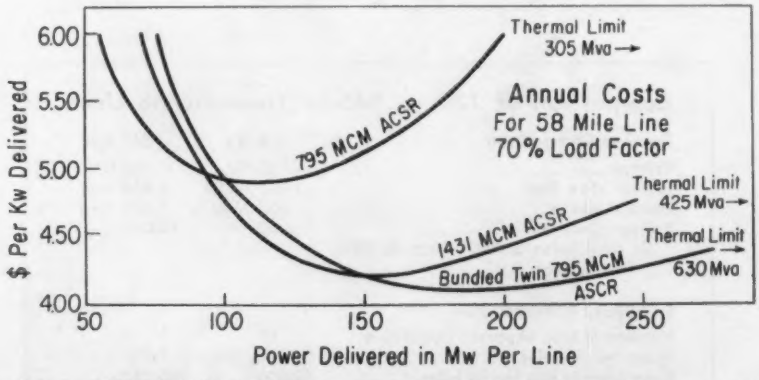


FIG 5—COST PER KW DELIVERED varies with such factors as conductor size, distance of power transmission, and, of course, the quantity of power delivered

MCM ACSR lines will have an optimum economic ability of 900 Mw and a thermal ability of 2,100 Mw. The economic studies, which determined the wire size, cover a 30-year period and recognize higher loadings later in the life of these lines.

A dollars per kw comparison of several wire sizes was developed. The equation for annual costs used in developing the comparison is: Annual Cost = Fixed Charges (A) + Losses (B) + Reactive (C) + Operating (D) + Maintenance (E) Where:

(A) Fixed charges at 15% of line including terminals are:
795 MCM—$2,008,000.
1,431 MCM—$2,675,000.
795 MCM bundled—$2,955,000.

(B) 1. Demand charge at $24.51 per kw per year.
2. Energy cost $0.0033 per kwhr (for 70% load factor).

(C) Cost of reactive supply $1.61 per kvar per year based on $10.70 investment per kvar.

(D) Operating cost $95 to $130 per mile.

(E) Maintenance cost $90 to $170 per mile.

1,431 MCM Favored

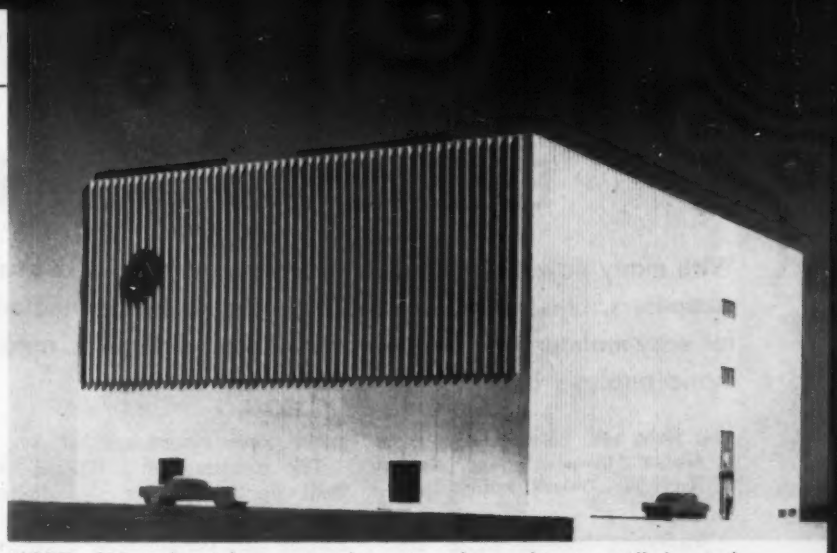
Reactive and I^2R losses for the 58-mile, 138-kv line with 1,431-MCM ACSR conductors were developed along with the typical annual costs for the line. For this line the 1,431-MCM conductor is more economical than the 795-MCM conductor for all loadings above 95 Mw delivered. Above 150 Mw delivered, bundled conductors appear to be more economical. After taking into account all the items of cost and loading over a 30-year period, however, the planners found that the return per additional dollar invested is lower than for the 1,431-MCM conductor.

When Consumers Power load has been quadrupled the system may look something like that in the illustration. Right-of-way may be a serious problem, although in this territory it appears that R/W can be obtained. But its costs in recent years have increased much faster than construction and other costs. Long-range planning has already accelerated the acquisition of right-of-way for future 138-kv substations and lines. Some line corridors

(*Continued on page* 118)

Newark Sub Will Have Eye Appeal

Public Service builds downtown switching station with all equipment within walls



MODEL of Newark switching station shows its modern architecture. All electrical equipment will be installed indoors; and its 138-kv feeders will be underground

All electrical equipment will be wholly within the walls of the downtown Newark switching station, which Public Service Electric & Gas Co now has under construction for operation by next summer. This new system addition will be fed by two 138-kv underground cables, one from the company's Essex generating station and the other from Bayway switching station.

Ultimately the station will have a capacity of 330 Mva, but its initial capacity will be about 165 Mva, which will not be utilized fully until load can be cut over from other locations. The two power transformers will be of the forced oil-air cooled type, rated 132-27.6-13.8 kv, with a delta stabilizing winding. Nominal capacity of each is 135/90/82 Mva. The 27.6 and 13.8-kv windings will have ±7.5% and ±10% tap changing, respectively.

Breakers Air Blast Type

All circuit breakers for switching at high voltage will be the air blast and air magnetic types, completely enclosed in metal compartments and grouped in several rooms. Use of these breakers will eliminate all oil except cable oil from the station, thus minimizing fire hazard and facilitating maintenance. The transformers will be cooled by air taken in through roof openings and forced over radiator-type coolers. Each transformer will be individually enclosed and sound proofed.

A central control room, completely isolated and air-conditioned, will house instruments and the latest carrier-current type of electronic relay protection for automatic switching of the 138-kv cables. The cables' relay protection will include separate relay circuits for the directional comparison carrier and directional impedance back-up relays to provide fast fault clearance in the event that a relay component fails to operate.

Each transformer will be connected directly to an incoming cable. Remote tripping for transformer faults will be by means of transistorized carrier sets. Other automatic devices for voltage regulation of the transformers in the control room will meet changing load conditions and switch the outgoing circuits.

The 103-by-157-ft building will have a full basement and will be 50 ft high to the top of the roof slab. A 14-ft-high parapet will enclose equipment on the roof. The building will have a structural steel frame above the first floor and poured-concrete floor and roof slabs. The first floor will be of flat plate construction, and there will be spread footings for columns and walls.

Except for the concrete block temporary end and the flat removable precast slabs at transformer bays, the exterior walls will be precast, pretensioned concrete members, 61 ft high by 4 ft wide. These are an adaptation of the double-tee members used for floor and roof construction on long spans; their use for exterior walls will be pioneered on this building.

Members will be installed vertically, stems of the tees on the outside, and cantilevered 14 ft above the roof. Joints between members will be caulked with oakum and sealed with synthetic rubber.

The precast sections, each about 10 tons, will be supported at the first floor level and clipped to angles fastened to the spandrel beams at floor and roof levels. Stems of double-tee members are 2 ft on center and project 8½ in. from the outside face of the slab portion. The prestress cables will be placed in the panels about the center of each tee and concentric about the neutral axis of the section.

Walls Built of Panels

Slabs are 5½ in. thick, of sandwich construction, with 1½ in. of plastic foam or fiberglas insulation centered in the slab. Two outer concrete slabs, each 2-in. thick, are reinforced with wire mesh and joined with shear ties. Panels for the exterior walls save money and erection time over masonry walls, and the building will present a modern appearance in keeping with Newark's development.

Public Service recently placed its Linden generating station in service and has two, one in Bergen County and one in Mercer County, under construction. These will increase system generating capacity from 2,554 to 3,774 Mw. Newark switching station will be one of several switching centers needed to distribute the additional power.

Extend Use of Digital Computers

With many power system problems programmed for digital computers, files of engineering data should be automated for easy maintenance and selection of data and quick, automatic analysis of many power system problems

TSAI HWA LEE, Computer Applications Analyst, Computer Dept, General Electric Co, Phoenix, Arizona

Increasing use of digital computers for utility engineering problems suggests an integrated and automated plan for power system analysis. This plan would use modern digital computer techniques to:

1. Maintain an up-to-date electrical equipment data file on magnetic tape.
2. Automatically select and edit various impedances from the data file for use in calculations.
3. Analyze results of completed studies to set up a new series of system studies automatically.

Application of this plan to power system analysis will maintain the electrical equipment data file on a daily or shorter time basis; will reduce the engineering labor and cost in routine calculations; and will speed the preparation of, eliminate errors in, and reduce the cost and drudgery of data preparation.

How would this three-part integrated plan work? Problems of power system analysis are concerned with studies of load flow, short circuits, stability, and transmission losses, and analysis of network circuits. While many of these studies have been programmed for quick and accurate solution on a digital computer, data for these studies must be gathered manually and tediously from an electrical equipment data file (EEDF). Furthermore, the EEDF is maintained on a manual basis and generally is not kept up to date. Thus, a natural step is to apply digital computer techniques to the maintaining of up-to-date data in EEDF as well as the selecting of data from the file for power system analysis. These phases may be applied to a digital computer with magnetic tapes to facilitate using a program of automated power system analysis.

The updating of EEDF is an ideal application for the digital computer. This file contains engineering data pertaining to electrical equipment in the bulk power and subtransmission system. It contains detailed information on the physical characteristics of generators, transformers, cables, transmission lines and other equipment which must be represented in system studies. For example, the physical characteristics of transmission lines include identification, nominal voltage, line length, conductor type and sizes, and tower configuration.

The EEDF also contains data for the equivalent impedances in per unit on some common kva base and the nominal voltage as base voltage. In the case of transmission lines, data would include the positive and zero sequence impedances and the shunt charging capacitance.

Data Tapes Kept Current

The utility power system is ever changing as new equipment is proposed and added old equipment retired, and existing equipment rearranged. The EEDF should be updated continually to reflect the latest condition of the electric power system. Each time a change is made in EEDF, calculations should be made to obtain the new equivalent impedances.

The entire file may be kept on one or more reels of magnetic tape with records arranged in sequence and key-coded. Changes in the physical characteristics or name plate data can be punched in cards and processed against the existing file to produce an up-dated EEDF. During this updating, the computer examines each record of the EEDF and is instructed to delete, compute and insert or change data already in the file.

The computer can select and evaluate the formulas for the positive, negative and zero sequence impedances according to the type of equipment. For example, for a transformer the equivalent per unit impedances can be computed using the name plate or test data; for a transmission line, the equivalent per unit impedances can be computed using wire type, size, tower configuration and line lengths. In addition, the computer can edit and rearrange the output according to the desired format for that type of equipment.

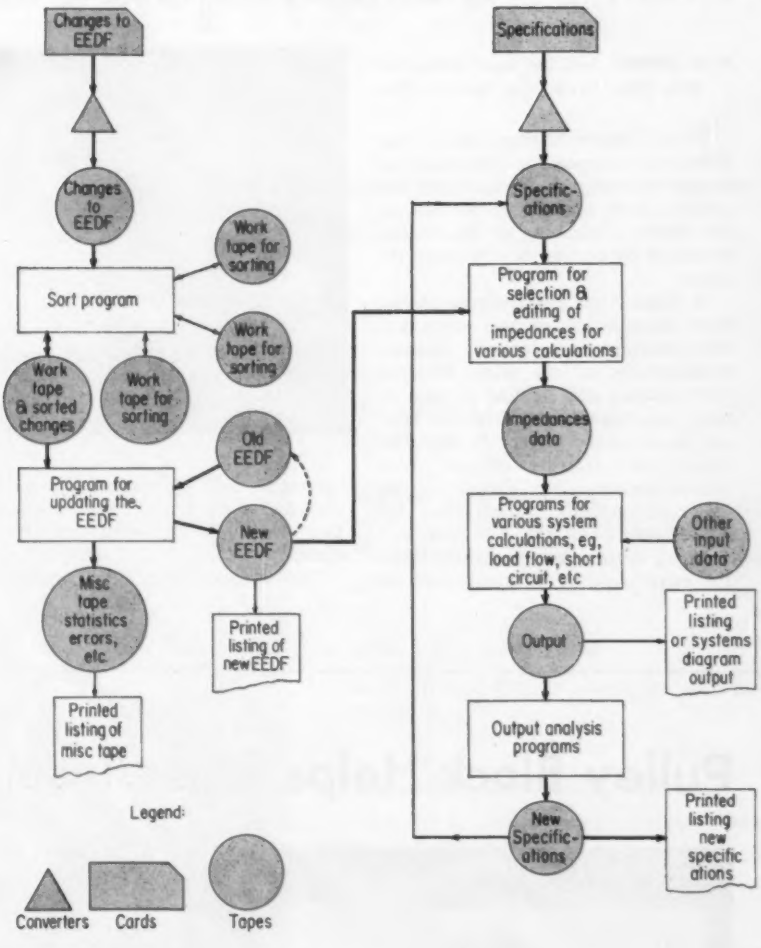
Automated maintenance of EEDF should reduce the up-dating time lag from months to days or hours. It also will relieve valuable engineering manpower and cost from the chore of routine calculations and record keeping.

The next step in the integrated plan is use of the computer to select and edit impedances as input to power system calculations. Impedances from EEDF are required with varying specifications to meet different types of calculations. The specifications generally call for:

1. The type of study and the equipment selected and its location: Short circuit studies would require only the Z; load flows studies would require the series $R+jX$ and shunt capacitance; transient stability studies would require not only the electrical impedances but also data on physical characteristics of steam or hydro generators.
2. The base kva used in the study: If the base kv used is not the nominal operating voltage, it should also be specified.
3. Format of the per unit impedances for the type of study, eg, whether the R's form a separate list from the L's, or a combined list; whether data is to be in floating point or fixed point, binary or decimal.

A general program for selection and editing of impedances can be prepared to obtain the desired impedances according to the specifications. This program will accept the specifications and work from the basic EEDF to select desired equipment, extract necessary impedances,

to Automate System Studies



INTEGRATED ANALYSIS of a power system calls for keeping electrical equipment data file on magnetic tape. The digital computer would be programmed to select the correct data for a particular problem and seek out "trouble spots" from which a new series of power system studies would be set up automatically

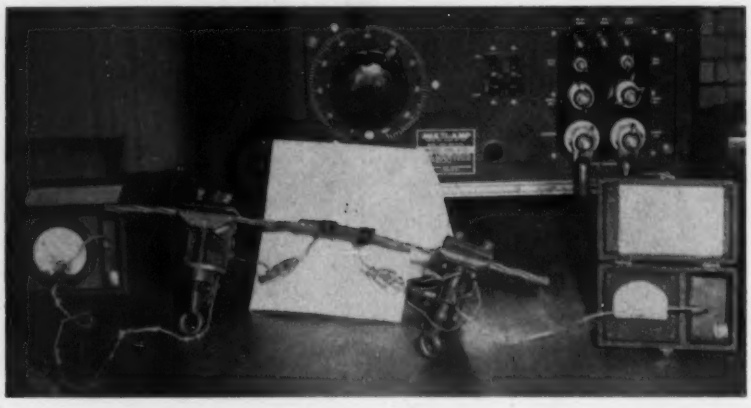
arrange them in the specified format, and properly scale and convert these to the right number form. Because the basic file is the EEDF, any new types of data required for new types of studies can be programmed easily and added to the existing library of specific selection and editing programs.

Putting this phase of the program on the digital computer will reduce the elapsed time required to prepare data for system studies. It will eliminate errors caused by manual preparation of data. Only a few numbers (the specifications) have to be written, instead of a large array of numbers to copy, scale, arrange and punch in cards. Computer handling also will reduce the cost and drudgery of data preparation for systems studies. In addition to handling these calculations, the computer can perform an analysis of the results. This analysis involves examination of the output to indicate trouble spots and make decisions according to the values of output. The trouble spots of a short circuit study may indicate which circuit breakers are overloaded. In a load flow study, they may point to overloaded or heavily loaded equipment, and areas where voltages are beyond the desirable limits.

The computer can use these trouble-spot indications to decide what should be studied next. For example, the heavily loaded equipment of a base case load flow study may indicate that the particular piece of equipment should be taken out of service for emergency studies. The areas of low voltage may indicate that the synchronous condensors or generators in that area should be taken out of service for emergency studies. The computer can use these indications to automatically set up a new series of studies. This integrated plan approach makes it possible for the power system engineer to utilize all the economics and flexibility of the digital computer that make it a valuable tool in planning and operating the power system.

Demonstration Shows Need for Clean Splices

H. K. JOHNS, Asst. Div. Supt. of Distribution, Ohio Power Co, Canton, Ohio



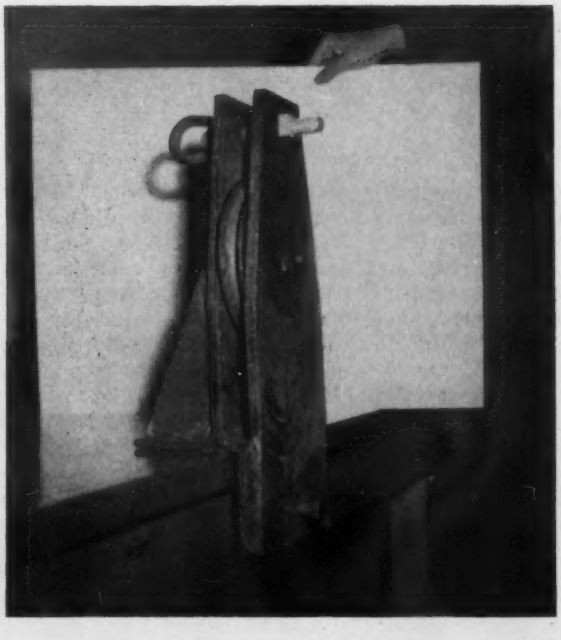
Visual demonstrations show Ohio Power Co linemen the importance of proper cleaning of transmission line splices. Tests are set up to indicate the effects of cleaning on the heating produced by current flow through the splice.

A Multi-Amp unit controls current flow through spliced test wires and direct-reading thermocouples measure temperatures of the wire. Identical wire samples and splicing sleeves are used for comparison. Excessive heating results at the surface of the splice when wires are not cleaned. With proper cleaning, the surface of the splice is actually cooler than the nearby conductor.

Using current values slightly above the rated capacity of conductors exaggerates the difference in heating caused by good and bad cleaning. This makes the demonstration more effective.

The Multi-Amp unit is normally used for field testing of reclosers and sectionalizers and is borrowed for demonstrations. However, any other low-voltage, high-current producing unit may be used.

Pulley Block Helps Raise Insulator Strings



W. SEAMAN, Line Supervisor, Long Island Lighting Co, Hicksville, N. Y.

A special pulley block is used by Long Island Lighting Co to connect sagged 1,192-MCM ACSR conductors to dead-end towers. Used on a 138-kv installation, the block eliminates separate rigging ordinarily required to lift heavy insulator strings to the point of tower attachment.

Made to seat on the end of the steel crossarms designed for dead-end towers, the pulley frame bolts to the end plate on the crossarm. An eye is provided on the top of the block for connection of a sling to the tower for added safety.

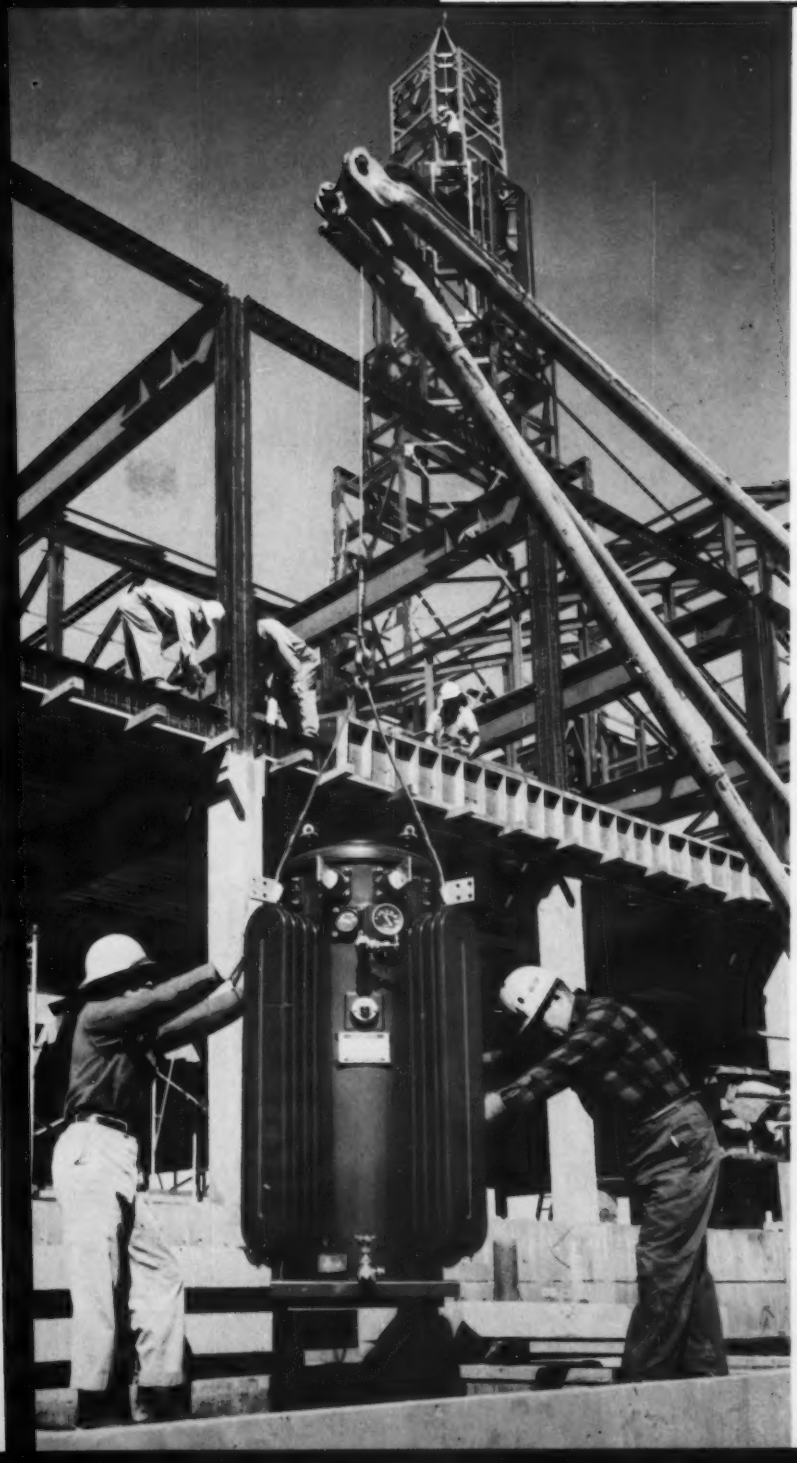
A pulling line is threaded through the block, and each conductor is pulled up to proper sag. The conductor is marked and lowered to the ground, where it is cut and assembled into a compression sleeve dead-end clamp to which is attached the string of 12 strain insulators.

The pulling line from the block is again fastened to the conductor and the insulators strapped loosely to the line with rope slings. The insulator string with conductor attached is raised and anchored to the tower.

(*More How To on page* 77)

DISTRIBUTION

Equipment News



In this issue . . .

- **ADDED KVA CAPACITY**

  for substations with new "Powermaster" Transformer, illustrated at left. See page 2.

- **LOW COST SWITCHING**

  with new G-E gas loadbreak cutouts. See page 4.

- **FIVE-COAT SANDWICH FINISH**

  adds life to Vaultmaster network transformers. See page 6.

HELPFUL PUBLICATIONS

Distribution Transformers

10 Reasons Why General Electric Is Your Best Transformer Buy—GEA-6070C

Self-protected Distribution Transformers—GEA-6126B

Lightning Arresters and Cutouts

New Form 3K Station Arrester—GEA-6794

Secondary Lightning Arresters—GEA-2977E

Open Dropout Fuse Cutouts—GEA-1816L

Flip Open Fuse Cutouts—GEA-4224E

Enclosed Fuse Cutouts—GEA-6208

Any of these publications may be yours at no cost by writing the General Electric Co., Section 431-83, Schenectady 5, N. Y.

GENERAL ELECTRIC

COMPACT NEW SUBSTATION TRANSFORMER design cuts installation space 29% over previous units.

New G-E "Powermaster" Transformers

Give pad and platform substations added kva capacity

Cooperation between the Detroit Edison Company and General Electric pays off for you with a new substation transformer design; the smallest, lightest, most efficient substation transformer on the market.

Rapid load growth in highly congested areas presented a recurring problem to Detroit Edison engineers: how could they get additional capacity where it was difficult to get space for more transformers?

Cooperating with Detroit Edison, G-E engineers solved the problem with a completely new 250-kva lightweight transformer for pole mounting. This prototype paved the way for an entirely new line of substation transformers which are easier to install, require less room, and possess improved operating characteristics.

Significant reduction in size and weight and improved electrical characteristics stem from a newly designed interior and exterior. Formex* wire is now used exclusively for turn insulation. New panel radiators are only 8 inches wide.

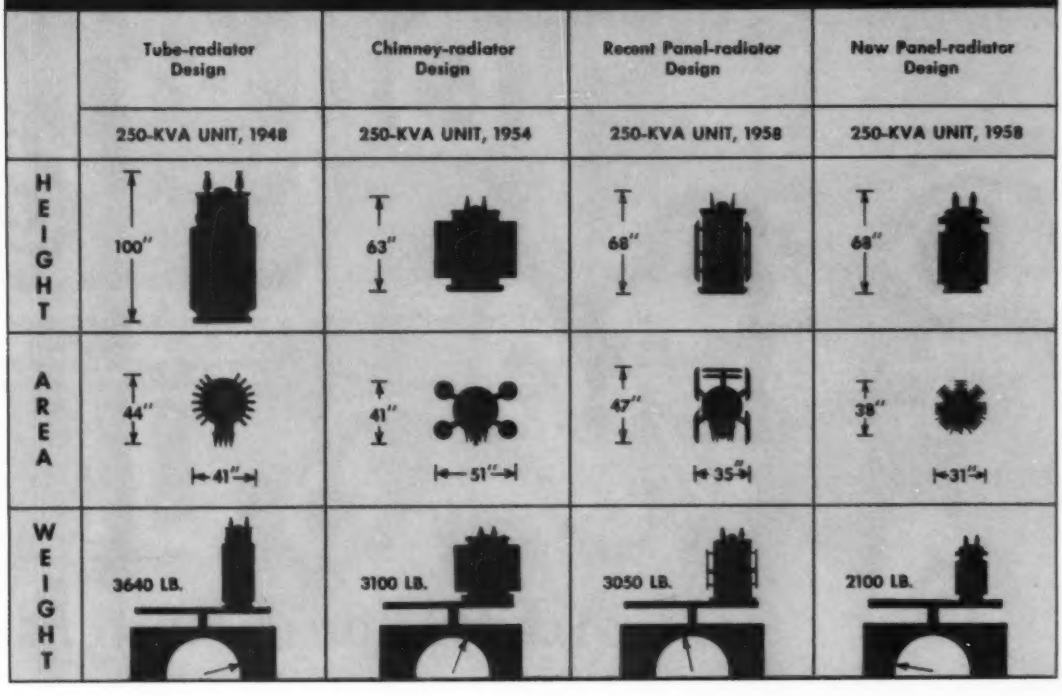
The pad-mounted substation units incorporate the same basic design improvements as the Detroit Edison pole-type units. In addition, they are fitted with tank base, externally operated tap changer, thermometer and liquid level gage. The new units conform to EEI-NEMA standards, and are available in ratings 500 kva and below, 15 kv and below.

**Registered Tradename of G.E. Company.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

10 YEARS OF SUBSTATION TRANSFORMER PROGRESS



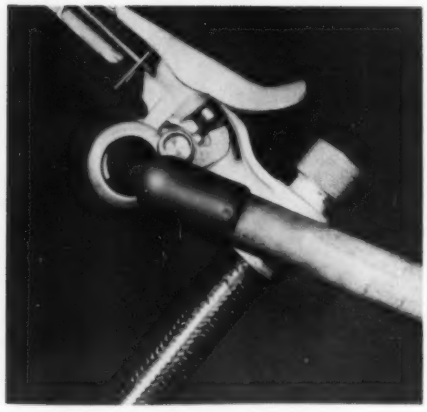
Detroit Edison and G-E engineers develop 250-kva pole-type transformer—paving way for new substation design

EDWARD G. ZIEGELER, Division Planning Engineer, Detroit Edison Company, reports on the 250-kva pole-mounted transformer whose features have been adapted for substation transformer use.

"The new 250-kva single-phase pole-type transformer helps us minimize congestion at transformer locations. Where lighting demand is in excess of 167 kva, we install one transformer, instead of two in parallel. In serving large secondary customers where the demand exceeds 500 kva we can install three 250-kva transformers. This eliminates the need for a second transformer cluster which is very often objectionable from a public relations standpoint, and usually difficult where space is at a premium."

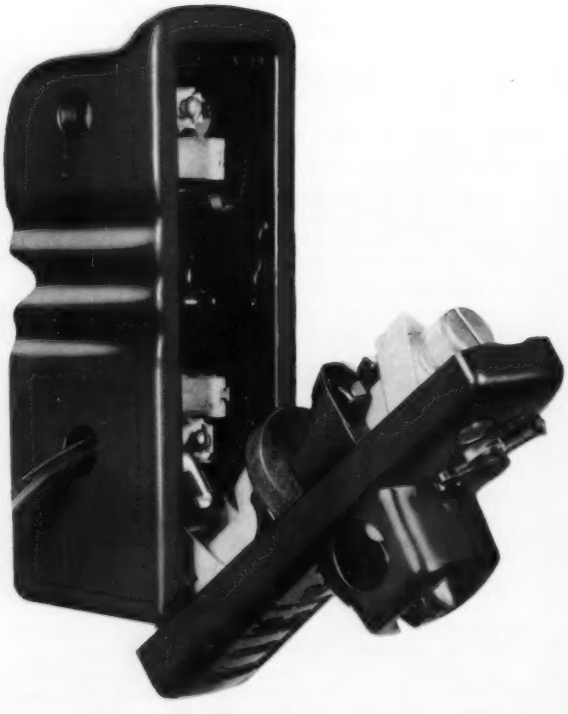
For complete information, contact your General Electric Sales Office, or write to General Electric Co., Section 431-83, Schenectady 5, N. Y.

MR. L. H. LANDRY, left, Electrical Apparatus Div. of Detroit Edison Company, and P. J. Robinson, General Electric Utility Sales, inspect first pole-mounted 250-kva unit delivered to Detroit Edison Company. New substation transformer design resulted from developmental work done on this pole-type unit.



1 **ALWAYS READY** and unaffected by weather conditions, a conventional switchstick is all that's required to "break load."

Full-load switching



Revolutionary gas load-break on open and enclosed cutouts blows out arc automatically

Now you can open circuits under full-rated load safely and economically with General Electric's new gas-operated load break. The gas load-break feature, first incorporated and proved in service on the G-E 100-ampere enclosed cutout is now available on all 7.8 and 15 kv ratings of G.E.'s open dropout cutouts including the disconnect blade.

Open or enclosed, the General Electric gas-operated load break can provide dependable low cost switching service over the entire distribution system. In addition, the lineman has complete control of the load break operation making opening under full load safer, easier and quicker. Existing G-E open type cutouts now in service can be converted to provide low cost switching. The fuse tubes for incorporating the new gas-load break feature are interchangeable with all G-E open-type cutouts of modern design. As part of the complete line of open dropout units available, a mechanical load break is also offered. Be sure to get complete details from your General Electric Apparatus Sales Office or write for bulletins GEA-1816 (open dropout cutouts) or GEA-6208 (enclosed units).

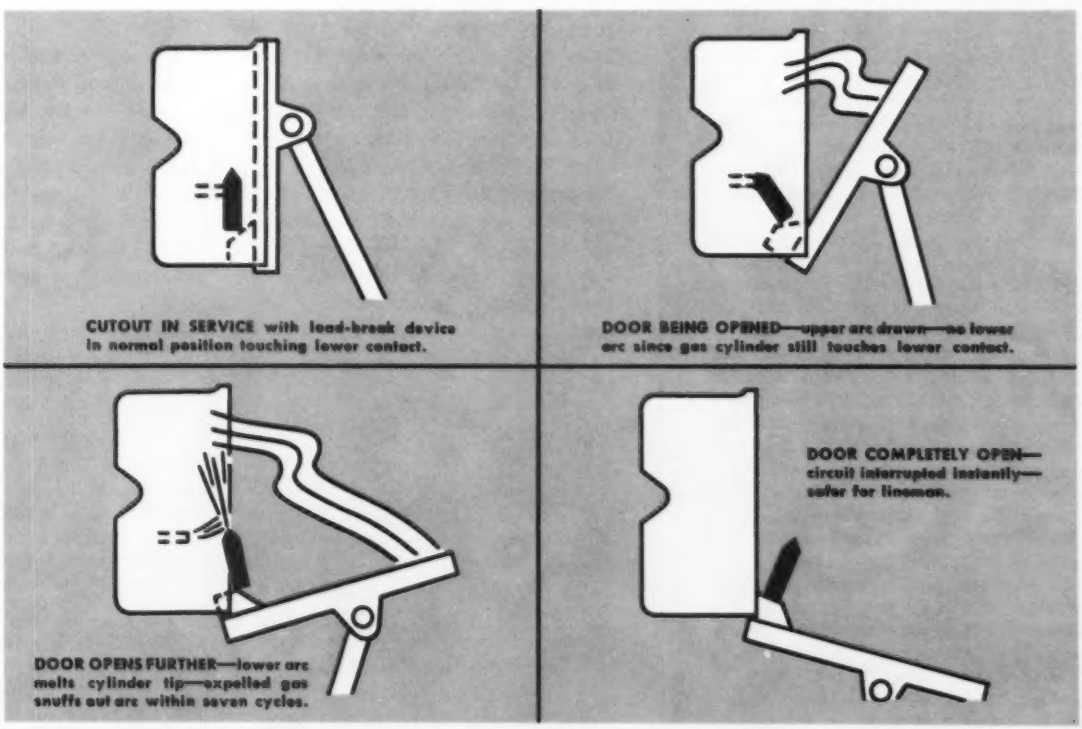
GENERAL ELECTRIC

2 **ARC IS DRAWN** between top contact and tip of monel gas cylinder. Load break has no effect on normal cutout function.

3 **ARC MELTS TIP** of the monel gas cylinder releasing blast of insulating gas. This new device makes opening under full load safer and easier for your lineman.

4 **ARC IS OUT** within 2 cycles at full load. Circuit now open. Fuseholder can be removed; cylinder replaced in seconds.

with new G-E cutouts


CUTOUT IN SERVICE with load-break device in normal position touching lower contact.
DOOR BEING OPENED—upper arc drawn—no lower arc since gas cylinder still touches lower contact.
DOOR OPENS FURTHER—lower arc melts cylinder tip—expelled gas snuffs out arc within seven cycles.
DOOR COMPLETELY OPEN—circuit interrupted instantly—safer for lineman.

Implications of the New Network Finish

HAROLD BRUNTON, JR.
Manager—Network Transformer Sales

Paint is always a major concern on network transformers. When you put a unit in a vault that is periodically flooded or filled with contaminants washed off city streets, corrosion is an ever-present problem. Chemical snow removal practices aggravate the problem.

Faced with this situation, General Electric's first approach was to put some extra "gunk" on the bottom of the transformer. This part of the tank and radiators took the worst punishment. After considering plastic, rubber and tar materials, we decided on an asphalt-type "undercoat."

The application worked fine until we discovered that occasionally the "undercoat" would separate slightly from the transformer. Apparently this is an inherent problem of such "undercoats." And when it happens, the "undercoat" acts like a boot.

Water running down the side of the tank collects in the boot which, instead of protecting the tank, then aggravates the corrosion problem.

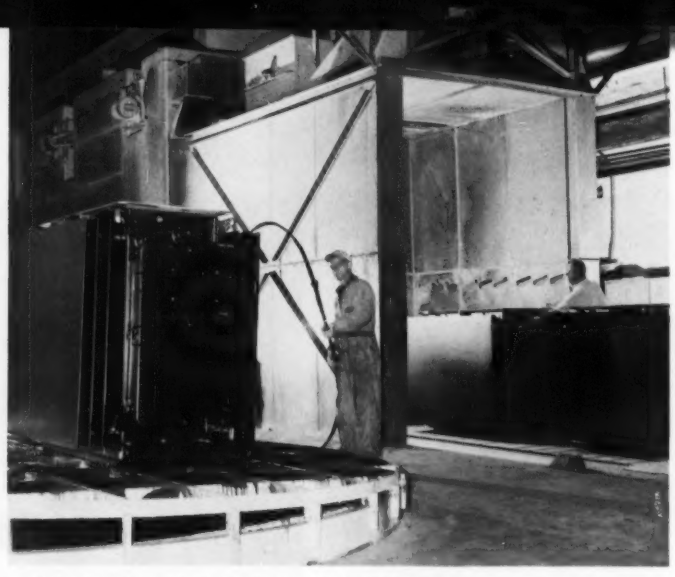
About this time, our laboratory came up with a new rubber-like paint called Melaprene which is applied to the tank surfaces. Results are almost unbelievable. In the "Weather-ometer" test, Melaprene lasts 6 times as long as our previous finish. In the standard ASTM accelerated salt-spray test,* Melaprene lasts more than 7000 hours compared to 1600 hours for the previous good finish.

We decided to apply this new paint as an extra protection on top of the previous finish. We painted the entire unit and used two coats instead of one. In 1957 we standardized the new paint system.

Subsequent experience revealed that Melaprene would discolor if left in sunlight. While the corrosion resistance was unimpaired, the appearance became unsightly with splotches of purple, yellow and brown. Our laboratory then developed a new Melaprene formulation which we "sandwich" between the base paint and an improved subway black, giving a finish which won't discolor in sunlight.

A few months ago, we started supplying transformers with the new paint finish. We believe that it is the best network transformer finish available today. Certainly we know it is far superior to anything G.E. has been able to offer. We believe it is a tangible ***extra value***.

*No. B-117-54T



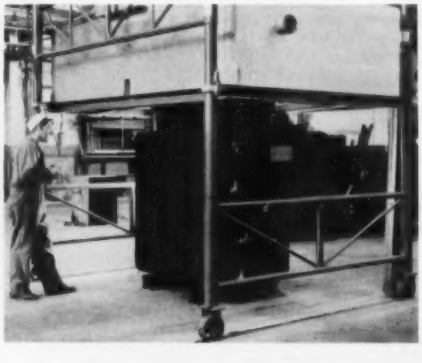
FLOW-PAINTING OF NETWORK TRANSFORMERS gives even coverage. The new conveyorized oven exactly controls the baking cycle.

New "Sandwich" Paint Process Applied To Network Transformers

The new G-E Vaultmaster network transformers are painted according to a new improved method. Instead of applying the finish coats directly over a base paint, the common practice, we sandwich Melaprene paint between the base and finish coats. This new six-step process gives longer finish life and improved resistance to sunlight.

Step 1—Carefully controlled grit/shot blast
Step 2—Base coat of red lead-chromate—Flowed-on and baked
Step 3—***Two coats Melaprene paint—flowed-on and baked***
Step 4—Two coats Subway Black paint—flowed-on and baked
Step 5—Complete finish on tank rim—same as Steps 2 through 4
Step 6—Touch-up—sprayed-on and air-dried.

As noted in Step 5, the superlative five-coat finish is applied on the tank rim to which the cover is welded. Rather than just use touch-up paint over the welded area, G.E. has built an adjustable infra-red oven which enables each coat of paint to be individually baked on.



Adjustable Overhead Oven permits baking individual coats of paint on cover and tank rim after cover is welded to the tank.

GENERAL ELECTRIC

POWER SWEEPER has cut the cost of cleaning parking lots to one quarter that required using the push broom method

DUMPING DEBRIS from the rear-mounted container is done by manipulating a lever located beside the driver's seat

Power Sweeper for Parking Lots Saves 75%

H. A. PETERSON, System Substation Supt, Florida Power Corp, St. Petersburg, Fla.

A power sweeper for cleaning five parking lots in the St. Petersburg area saves Florida Power Corp about 75% over the former push-broom method. This saving includes depreciation and maintenance of the sweeper.

The sweeper is used to maintain 40,000 sq yd of parking area in five lots; four at substations, and one very large lot at the Operation Center. These lots are cleaned approximately every 30 days; but the frequency depends on traffic, rain-fall, wind, etc. Cleaning requires about 94 man-hr. Of this, one-third must be done on week-ends at time-and-a-half pay rate, and the balance is cleaned at the regular rate.

When the sweeper is not in use, it is stored at the Operation Center. It is transported to the substations on a small trailer, which is also used for other purposes.

The sweeper, powered at 4 mph by a small gasoline engine, has two brushes. The smaller one is used for cleaning up to curbs, and the other sweeps a 36-in. swath. Debris is swept into a container at the rear of the unit.

Controls for dumping the container, positioning the brushes, and engaging the driving gears are located conveniently to the right of the operator's seat. Throttle, brake, and clutch pedals are mounted on the floor.

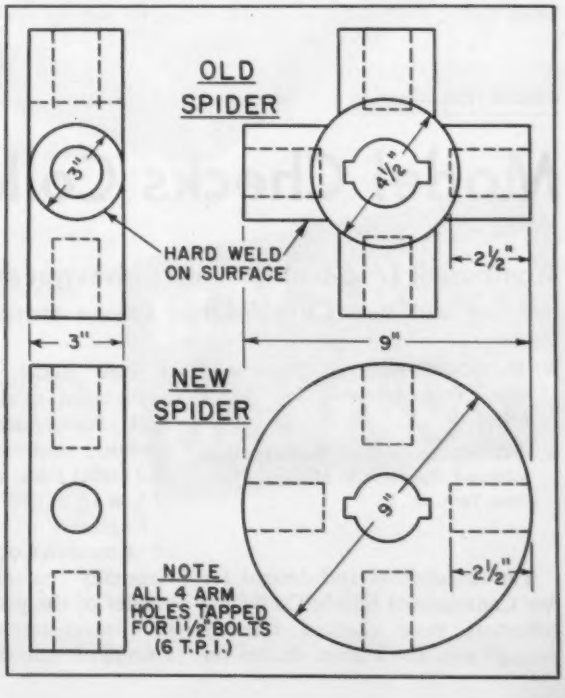
Triple Life of Mill Inlet Spider

O. A. HESSON, Maintenance Foreman, Appalachian Power Co, Cabin Creek, W.V.

An improved design triples the life of ball mill inlet spiders used by Appalachian Power Co. Total annual savings are expected to be more than $1,000.

The spiders now used are fabricated in the company's shop at a cost of about $18 each. Blocks of cold-rolled steel are turned on a lathe to a 9-in. diameter and holes are bored and tapped.

The solid body of the improved spider design provides more protection against the action of pulverizer balls. The exposed arms of the old design were constantly eroded by the tumbling action of the mill balls. Spiders of the newer type installed over 2 yrs ago are still giving satisfactory service, while the older spiders had to be reconditioned each year.



FLOW PATTERN is studied by two Research-Cottrell engineers during pre-installation model studies for two fly ash collectors. Installations will clean 1.4-million cu ft per min of flue gas at 300F from large power station boilers

GENERATION—Testing

Model Checks Collector Design

Transparent 1/16-scale miniature gives gas distribution data proving out two Consolidated Edison station installations

W. W. MOORE, New York District Manager, Research-Cottrell, Inc, Bound Brook, N. J.

H. KNECHT, Steam Plant Engineer, Consolidated Edison Co of New York, New York, N. Y.

The calculations and designs for two Consolidated Edison Co fly ash collectors were checked recently through gas distribution studies on a scale model. For the studies, a Plexiglas model, complete with inlet flues, mechanical collector section, electrostatic precipitator, and outlet flues, was built in a ratio of 1 to 16 in size.

Engineers of the company and of Research-Cottrell, Inc., made unusually complete and careful studies of the problems inherent in such steam-station installations. As a result of such careful preparation, both companies are confident that few, if any, modifications will be necessary to secure efficiency and carefree operation.

From the economic standpoint, the model studies, it is believed, will obviate lengthy shutdowns of the full-scale installation for alterations or modifications to improve gas flow. Gas flow patterns are of paramount importance with regard to the precipitator. The models give a clearer grasp of the installation than could be had from drawings. And studies of the model enable operating and

(Continued on page 82)

There IS a Difference!

Connectors may look alike but it's PERFORMANCE that counts

BLACKBURN CONNECTORS OUT-PERFORM THEM ALL

Because They Are . . .

BETTER MECHANICALLY

- Made of high strength duronze, a silicon bronze alloy stronger than structural steel.
- Machine cut threads, *CFC treated, provides more thread engagement —reduces friction and increases thread efficiency. *Chemical Friction Control.
- Rigid inspection of each production operation assures uniformly good connectors.

BETTER ELECTRICALLY

- High clamping force—the result of greater thread efficiency breaks down oxide on the conductor improving conductivity.
- Higher initial conductivity, actually greater than an equal length of conductor is maintained permanently.

REUSABLE

- Selection of proper high-strength, corrosion-resistant materials—plus precision workmanship and inspection—means Blackburn connectors may be used over and over.

BLACKBURN *Hi-Strength* **CONNECTORS**

AVAILABLE AT ELECTRICAL WHOLESALERS EVERYWHERE

JASPER BLACKBURN CORP., 1525 Woodson Rd., St. Louis 14, Mo., WYdown 3-9430

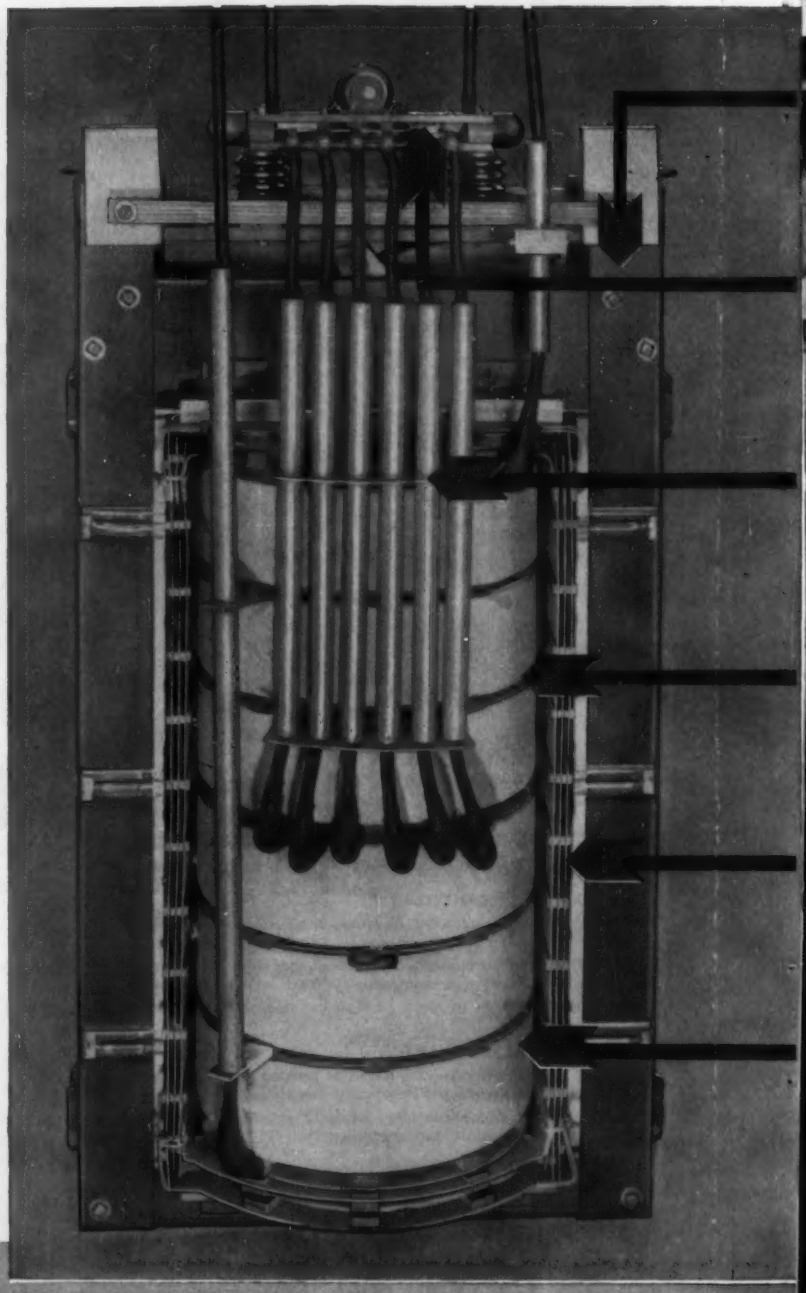
Internal Ruggedness...

POLE STAR

As a general rule, the higher the voltage, the more essential it is that transformer service be continuous and trouble-free. This is true from the standpoint of economics as well as that of customer satisfaction . . . and it is why Pennsylvania gives you *extra* ruggedness where it counts the most, in high voltage Pole Stars.

Take a look at the interior design features shown on these pages and see for yourself. From the patented lap-on-top core to little noticed lead supports, Pole Stars are designed and constructed to deliver *sustained performance* in every type of transformer installation. You can rely on Pole Stars for long range economy and dependability throughout the complete range of EEI-NEMA ratings: through 500 kva, through 67,000 volts, single phase. Pennsylvania Transformer Division, McGraw-Edison Co., Canonsburg, Pa.

The unit pictured is 500 kva. High voltage: 67,000 volts. Low voltage: 7560/13,090Y volts. Construction features shown may vary somewhat in other voltage classes.



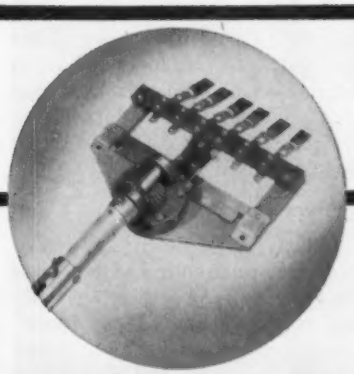
PENNSYLVANIA TRANSFORMERS pt

PENNSYLVANIA

key to sustained performance of high voltage

POLE STARS

ANGLE-AND-CHANNEL CORE FRAME



Core-and-coil assembly is supported by a sturdy, pressed steel, angle-and-channel frame, which is securely fastened together by bolts with permanently positioned nuts.

STRAIGHT-LINE TAP CHANGER

Straight-line tap changer is of same rugged design as that featured for years on Pennsylvania Power Transformers. Sintered silver-nickel contacts possess electrical qualities of silver and wearing characteristics of nickel.

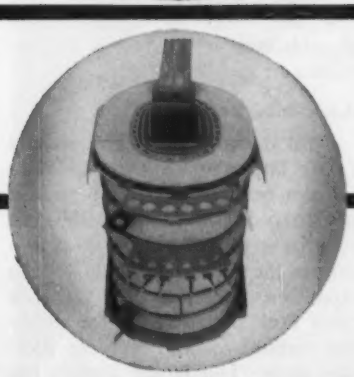
INTEGRAL LEAD SUPPORTS

High voltage leads are insulated in pressboard tubing and held firmly in position by supports that are an integral part of the coil.

LAP-ON-TOP CORE

Core features Pennsylvania's patented lap-on-top construction. Laminations are individually lapped, creating a large cross-section area at lap that reduces density and prevents concentration of flux. Absence of gaps or butt joints assures low exciting current.

INSULATION AND BRACING



Coils are "packed out" with insulation to securely lock core and coil together. Maple braces provide extra support at top and bottom and help to protect against possible short circuit forces.

SECTIONAL COIL

High voltage windings are sectional, with low voltage layer windings inside. Use of sectional coils in higher voltages improves insulation . . . permits weight and size reductions. Also results in uniform distribution of impulse voltage and greater resistance to short circuit.

DISTRIBUTION TRANSFORMERS

field engineers to orient themselves better to working on the actual installation.

The collectors were designed for incorporation into the company's Unit 30 and Unit 20, respectively at Astoria and Arthur Kill stations. They are two of the largest and highest efficiency collectors ever designed for the removal of fly ash. As they were designed initially as duplicates, except for the outlet flues from the precipitator exits to the stacks, only the installation at Astoria will be referred to hereafter.

High Efficiency Sought

Con Edison's specifications established for the dust collectors a gas volume of 1,400,000 cu ft per min at 300F from a reheat boiler generating 2,500,000 lb of steam per hr. The specified volume includes a margin over that actually calculated from the boiler performance. The dust collector was to have a design efficiency of removal of 99%.

The specifications outlined the boiler size and capacity and a proposed station arrangement. Each boiler was to have four air heaters and an overall width of 131 ft. The collector width to accommodate the tremendous gas volume and removal efficiency had to be considerably in excess of the boiler width. The specifications proposed an arrangement which allowed the dust collector manufacturer a width of 178 ft. Existing facilities and plans for future units necessitated offsetting the center of the dust collectors about 36 ft from the boiler center line. This offset and the number of air heaters prompted a decision to split the dust collectors and to handle the gases from half of each boiler and two air heaters through separate collectors.

Collector Has Four Units

Each of the two collectors for the boiler was designed to consist of four units, each arranged with a mechanical collector section followed by four sections of electrostatic precipitators in series. Each electrostatic precipitator unit will have 26 ducts, each 20 ft high by 22 ft long, the latter dimension made up of four 5 ft 6 in. sections. The electrostatic portion will be energized from 16 25-kva, 50-kv vacuum tube half-wave rectification-type electrical sets. There will be a spare transformer rectifier set.

The vacuum tube sets will incorporate a monocyclic network, which will give the same power output at the discharge wires, with a lower input power to the electrical equipment. In essence, a monocyclic network gives higher conversion efficiency and greater operating stability, with reduced power input over a resistance-type network.

Each electrical set, consisting of control and transformer-rectifier units, will be in an outdoor enclosure at the precipitator roof level. The enclosures will be in a line to which a pair of tracks will run parallel.

The high-efficiency collector incorporates a double-deck mechanical collector arrangement preceding the electrostatic portion. Studies showed that a step header for the upper bank of the mechanical collectors and redesigned hoppers for this bank greatly improve gas distribution. This design will be incorporated at Astoria.

Have Top Rapping

Top rapping will be utilized for both the collecting plates and discharge electrodes of the precipitator portion. The collecting plates will be of expanded metal flat plate design; the discharge electrodes will be Type 304 stainless steel wires. Arrangement of the electrode system will be the wire and weight method which keeps electrodes plumb and taut.

Introduction of a dust-handling building between the air heater outlets and the collector inlets restricted the arrangement of the flue. The flue arrangement from the air heaters will have an upward turn of 143 deg over the dust-handling building and a similar downturn to the collectors' inlet. As one collector is about 36 ft off the boiler's center line, it was necessary to flare out of the flues in an offset on one collector.

Before building the Plexiglas model, three-dimensional cardboard models were constructed of the inlet flues which will largely affect gas distribution. On the basis of studies with these preliminary models, the transparent model was built.

Plexiglas was selected for construction of the models because it is easy to handle, permits internal viewing, and, in a finished model, presents a neat appearance. The ratio selected had proved satisfactory in other studies, such models being large enough to permit representative and accurate detailing. In building the model, geometric similarity was maintained on all internal surfaces touched by gas.

Previous model studies had shown that a $\frac{1}{16}$-scale model projects actual field results when it uses gas of 1/5 of the Reynolds number of that in the full-scale equipment. This holds true as long as the Reynolds number in the model is kept well above the critical number of 2,000. For visual studies of the flow gas patterns, titanium tetrachloride visible gas was used, the flow being observable through the medium of threads mounted on probes at given positions.

Splitters Joined

Initially, splitters divided the inlet flue in each collector into three equal sections wherever gas direction changed. But further thought dictated that these major splitters be joined, and each major section was divided into eight smaller ones at every horizontal turn. All shapes, radii, and length of turning vanes and splitters were calculated, designed, and drawn before their incorporation in the model. Operation of the model confirmed the need for any further changes.

The north precipitator with the large flue offset seemed, at the outset, to present the most difficult problem. But it turned out that it was by far the easier of the two inlet flues in which to obtain satisfactory results. The offset resulted in an additional expansion in the direction of gas flow.

Shock Loss Studied

Until the model studies revealed it, the importance of shock losses had not been fully realized. These are sharp discontinuities within the boundaries of the gas flow, such as a strut in the gas stream, or a sudden expansion of the gas. Shock losses upset flow patterns, induce excessive turbulence, and increase pressure drop. The model studies implemented a considerable reduction of these losses which, in the actual installation could have been so enormous that the boundaries of disturbance would be difficult to define.

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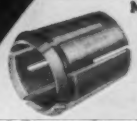
- Fully molded, no factory taped joints.
- Insulated with MYPAR* rubber for higher quality and longer life, or MYPRENE* rubber for higher temperature resistance, and greater resistance to acids and oils.
- Made of high conductivity copper, insuring cool operation.
- Interchangeable with all standard underground connectors and their component parts.
- Made to fit standard compression tools.

MICON* type MC

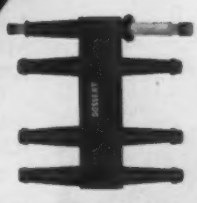
MICON COMPONENTS



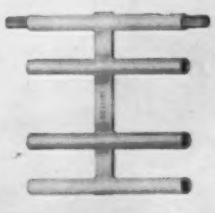
Tapered Compression Sleeve type C

Cable Receptacle type MA

Insulating Sleeve for MICON Outlet type MIS

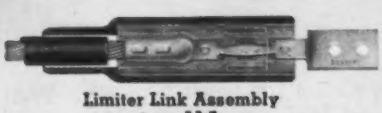


Insulated Crab Connector type CBR

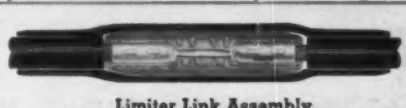


Uninsulated Crab Connector type CBN

MICON Stud Connector type MCBS



Limiter Link Assembly type LLA



Limiter Link Assembly type NLRA

Terminal Lug type DPL

Comp. Coupler type DPC

Comp. Tee Coupler type CRT

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Insulation Developed for 'Red Hot' Motors

An electric motor while in a temperature of nearly 1000 F has operated continuously over extended periods—more specifically over 100 hr. It not only survived, but was able to do useful work at 1200 F. This was the result attained with some a-c motors in experiments run by Westinghouse Electric Corp. Some versions of the "red hot" motor have run continuously at 950 F for as long as 1000 hr.

The motor was designed to test, in as severe a practical application as possible, the performance of a new system of electrical insulation for motors, transformers, relays and other electrical equipment required to operate at very high temperatures. The new insulation offers promise for initial use in electrical equipment in supersonic planes, rockets, and missiles. Ultimately it is expected to raise temperature limits of motors for industrial applications.

Experiments have been run with 110-v a-c motors as large as 5 hp. The picture shows a 0.5-hp motor driving a tool grinder while almost "broiled" in the heat from burning gas. This motor has graphite bearings and is wound with silver wire.

The new electrical insulation was developed by a team of four scientists,—Dr. E. J. Croop, manager of insulation and chemical development in Westinghouse materials engineering departments, C. H. Vondracek, D. C. Westervelt, and C. F. Hoffman.

Dr. Croop said that the insulation system is composed entirely of inorganic materials, including inorganic binders to bond the insulation permanently to the wire it protects.

Principal components of the system are:

A. Phase and slot insulation is flexible sheet material that consists of glass cloth and large mica flakes bonded with phosphate.

B. The wire is insulated by covering it with glass fiber and then impregnating it with a suspension of powdered mica in a phosphate solution. When so insulated, the wire is flexible and can be wound into motors in a conventional manner.

C. After winding, the motor is impregnated and potted with a liquid slurry consisting of a phosphate solution, Wollastonite, silica and other chemically reactive materials. The potted motor is dried out to remove free moisture and then pyrolyzed above 600 F to develop the best properties.

Dr. Croop added that the insulation also has been tested in solenoid coils, in small transformers, and in other devices.

Anodized Aluminum Wire Promising for Windings

Continued encouraging results from its research on anodized wire for use as a winding for electric motors, transformers and other equipment have been reported by Aluminium Ltd, Montreal, Canada. The basis was nearly four years of experimental work at the aluminum producer's Canadian research facilities.

Nine advantages of anodized aluminum wire are listed in a report on its development by Paul Smits, an Aluminium Ltd research expert. They are: High temperature resistance; low space requirements; good heat dissipation; resistance to organic solvents; light weight; the wire is a good base for overcoating materials; uniformity of covering; low cost; and good resistance to abrasion.

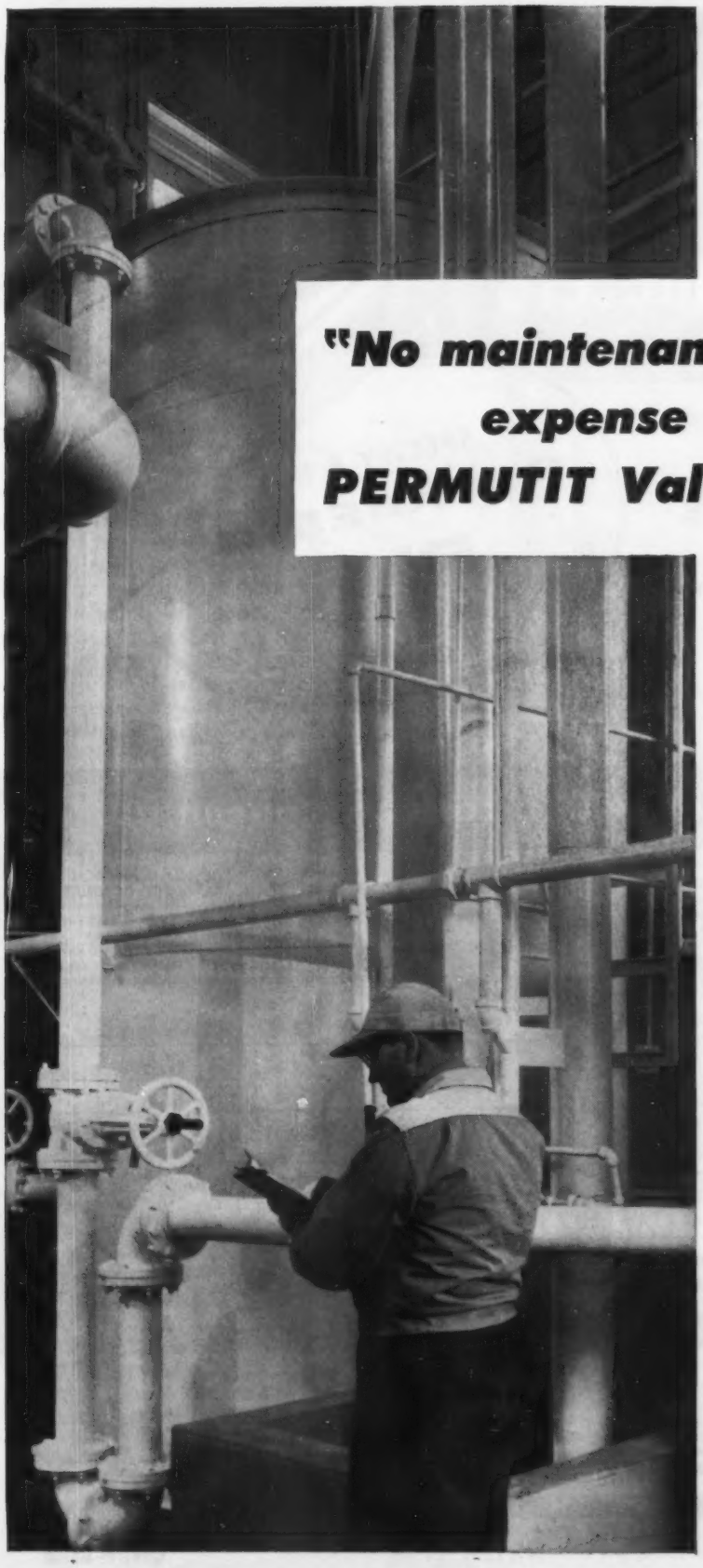
The report showed that there was no decrease in the dielectric strength of the anodic insulation at up to 600C. "Limited test data indicate that there is no deterioration of the oxide insulation with time at these elevated temperatures," the report continued.

Water Content in Snow to be Telemetered

An electronic-telemetering system for measuring the water content of mountain snowpacks is a development by Sierra Electronic Corp, Menlo Park, Calif., and the U. S. Army Corps of Engineers. One system, to be placed in operation this winter, is being installed in California's Sierra Nevada mountains; another in the Bitterroot mountain range in Idaho.

This snow gauging equipment is

(Continued on page 87)



One of two Permutit Automatic Valveless Water Filters at O. M. Scott & Sons Co. Chemical Products Plant, Marysville, Ohio. Each filter is 7' diam. and rated at 116 gpm. The complete Permutit water-treatment system was engineered by H. A. Williams and Associates, Columbus, Ohio.

"No maintenance or operating expense with our PERMUTIT Valveless Filters"

- These filters have been operating continuously for over a year and a half . . . supplying water for process, boiler feed and drinking. They follow a Permutit Precipitator that treats raw well water with lime, soda ash and coagulants. Either filter can handle full feed rate during inspection or repairs on the other.

- Here's how Glenn L. Moll, Scott's Service Manager, puts it: "Our Permutit Automatic Valveless Filters are operating very satisfactorily. The filter-bed and underdrain system stay clean with no evidence of blow holes or sifting of filter media to the underdrain system. We now inspect them only twice a year."

- The Valveless Filter is completely automatic—yet costs up to 45% *less* than conventional automatic gravity filters because it uses no expensive valves, flow controllers, pumps or hydraulic or pneumatic control systems.

Send for descriptive bulletin. Address: The Permutit Company, Dept. EW-11, 50 West 44th Street, New York 36, N.Y. or Permutit Company of Canada, Ltd., Toronto 1, Ontario.

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HERE'S THE PROOF WHEN IT COMES TO CONDUIT FILL

No. 12 A.W.G. (19/25)		1 CABLE PER CONDUIT				2 CABLES PER CONDUIT				3 CABLES PER CONDUIT				4 CABLES PER CONDUIT			
		Max. Cable Dia."	Number of Conductors in one Cable			Max. Cable Dia."	Number of Conductors in one Cable			Max. Cable Dia."	Number of Conductors in one Cable			Max. Cable Dia."	Number of Conductors in one Cable		
COND. SIZE.		Table 11 N.E.C.	ROCK PNR	3/64"	4/64"	Table 11 N.E.C.	ROCK PNR	3/64"	4/64"	Table 11 N.E.C.	ROCK PNR	3/64"	4/64"	Table 11 N.E.C.	ROCK PNR	3/64"	4/64"
½"	New Work	.450	2-4			.243				.234				.195			
	Rewiring	.479	2-4			.276				.252				.218			
¾"	New Work	.598	5-7	2-3		.323				.311				.260			
	Rewiring	.636	5-8	2-4	2	.367				.335				.290			
1"	New Work	.762	8-14	4-7	2-4	.412	2-3			.396	2						
	Rewiring	.811	9-16	5-8	3-5	.468	2-4			.427	2-3						
1¼"	New Work	1.000	15-18	8-12	5-8	.543	4-5	2-3		.523	3-5	2-3					
	Rewiring	1.070	17-18	9-16	6-9	.618	5-8	2-4		.564	4-5	2-3					
1½"	New Work	1.170		13-19	9-12	.634	6-8	4	2	.610	6-7	4					
	Rewiring	1.248			10-14	.721	9-11	5-7	2-4	.658	8-9	4-5	2				

This is an excerpt from the Rockbestos Control Cable Conduit Fill Chart covering sizes A. W. G. 9, 12, 14. Write today for your free copy. Ask for PNR 1-58.

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ROCKBESTOS

PNR
Small Diameter Control Cable

MORE THAN 16,000,000 FEET IN SERVICE

(Continued from page 84)

designed to report and record hydrological data (water content of snow) from remote, unattended areas. The data are useful in planning and operation of hydro-electric plants, flood control programs, and irrigation projects. Presently the data are obtained by sending men and equipment to survey selected snow fields which are often inaccessible.

The telemetric system, known as Model 211A, basically includes a radiation detector of the scintillation type, a radio transmitter receiver, battery, and control unit. Electronic equipment was developed by Sierra, a subsidiary of Philco Corp.

Water content of the snow is measured by radiation supplied by a small deposit of radio-active cobalt buried at ground level. Directly above the cobalt, at a height of 15 ft, is the radiation detector. Sierra states that only the water content, not the depth of the snow, affects the radiation. Impulses from the detectors at the gauge sites are relayed to the base station. Highest gauge site is at 11,500-ft elevation, about 10 miles from Mt. Whitney.

According to the manufacturer, the system can be expanded to report temperature, barometric pressure, humidity, wind velocity, stream gauging and controlling cloud-seeding equipment.

Large Rectifier System Started at Hooker Chemical

The first of four 360-v, 12,000-amp, 13.8-kv silicon power rectifiers went into operation October 1 in Hooker Chemical Corp's Niagara Falls, N. Y. plant. The system is reportedly the largest of its kind.

The General Electric rectifiers, costing more than $1 million installed, will constitute the major segment of Hooker's gradual changeover from 25-cycle to 60-cycle power for conversion to direct current. When the final installation is completed, in six months, about 75% of the plant's operations will use 60-cycle power. Principal reason for the changeover is the increasing unavailability of 25-cycle power.

(Continued on page 88)

INTERCHANGEABLE DOORS provide a quick easy means of converting Type E Cutouts to a higher interrupting rating or to a disconnect. Each housing will accommodate three different door assemblies.

NEW CHANCE
10,000 AMP CUTOUT

new ease of operation... interchangeable ratings... resiliency to resist shock

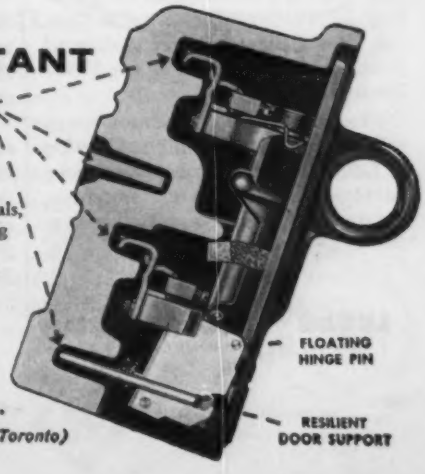
These new porcelain enclosed cutouts cover the complete range of NEMA ratings in 50 and 100 amp cutouts, and 100 and 200 amp disconnects. Rated 5.2 and 7.8 KV, they have interrupting capacities from 2,000 to 10,000 amps.

Special socket inside the door permits doors to be completely installed and removed from any angle or position with a standard hook stick—an *important feature to operating men.*

The "E" Cutout can be used as a flag indicating cutout with the built-in drop-down flag that signals an outage, or as a full 180° dropout cutout that permits easy removal of door with a hook stick.

SHOCK RESISTANT
EPOXY RESIN
MOUNTING

The use of epoxy resin mountings gives strength and resiliency to contacts, terminals, trunnion, and mounting hanger. A floating hinge pin and mounting of the door assembly on a resilient trunnion gives full protection against door breakage. Ribbed housing provides high dielectric strength.



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CUSTOM CUSTOM

Answers to operating problems:

ECONOMY INTERCHANGE

PROBLEM: Many System Operating Engineers have found that the growing complexity of interchange contracts calls for automatic calculation of generating costs, line losses, economy interchange costs, interchange billings, etc. Although they can justify a computer for this purpose, they cannot recommend the addition of a second computer for automatic dispatch . . . even though such equipment would be desirable.

SOLUTION: Installation of a Leeds & Northrup "Desired Generation" Computer-Control. This dual-function computer serves as an automatic dispatching tool and, when required, solves anticipated load problems. When equipped with an X-Y plotter, the computer makes a graphic presentation of (for example) any of the following "X" coordinates with any of the listed "Y" coordinates:

X—Total System Load, Total System Desired Generation, Total Steam Desired Generation, Station (or Unit) Desired Generation.

Y—System Incremental Cost, Station or Tie-Line Incremental Cost, Inc. Per Cent of Power Delivered from any source, Station (or Unit) Desired Generation.

Similarly, there are many ways in which you can select a combination of L&N custom controls to meet your particular requirements. For details, see an L&N Field Engineer, or contact 4938 Stenton Ave., Phila. 44, Pa.

LEEDS Instruments N NORTHRUP Automatic Controls • Furnaces

Large Rectifier System

(Continued from page 87)

Each of the units will have closed cycle cooling and will be rated for a continuous electrolytic load in the production of chlorine and caustic soda.

Substitution of the first silicon rectifier unit for three rotary converters was accomplished in 13 hr, permitting the power load to return to normal in record time.

Westinghouse Net Income Up for Third Quarter

Net income of the Westinghouse Electric Corp in the third quarter, after provision for taxes, was the best since 1950 and was 11.5% higher than income in the second quarter of this year, according to Gwilym A. Price, chairman of the board.

He said that backlogs of orders for the company's industrial, defense and atomic products continue firm, with total backlogs down only 6.5% from a year ago. Only the backlog for apparatus products has been affected by the general business decline of 1957-58.

Although net sales billed in the third quarter declined 6.8% from the third quarter of last year, net income rose 3%, Price said. For the first nine months of this year, net income declined 0.2% from the earnings in the first nine months of last year on a 6.3% decrease in sales billed. In both 1957 periods sales billed were a record for the company.

The net income in the third quarter of this year was $19,038,000, equal to $1.09 on the 17,070,543 common shares outstanding, compared with $18,487,000, equal to $1.07 on the 16,840,988 common shares outstanding in the third quarter last year. Net sales billed for the period this year were $460,538,000 and for last year, $494,334,000.

Net income for the first nine months of this year was $49,011,000 on sales billed of $1,384,499,000 and net income in the comparable period a year ago was $49,102,000 on billings of $1,477,273,000. The net income for nine months of 1958 was equal to $2.79 a common share against $2.83 for

(Continued on page 90)

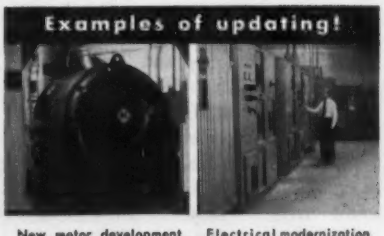
ALLIS-CHALMERS

ALLIS-CHALMERS

NEW brochure of ideas for modernizing

This booklet is based on the premise that modernization can start anywhere in your plant. It can be a single machine or operation . . . a better way of getting variable speed . . . a faster way to braze . . . or a newly available replacement. In fact, this type of updating is far more common than the sweeping change.

Get a copy of "59 ideas for modernization in '59" from your nearby A-C office or write Allis-Chalmers, Industries Group, Milwaukee 1, Wisconsin.

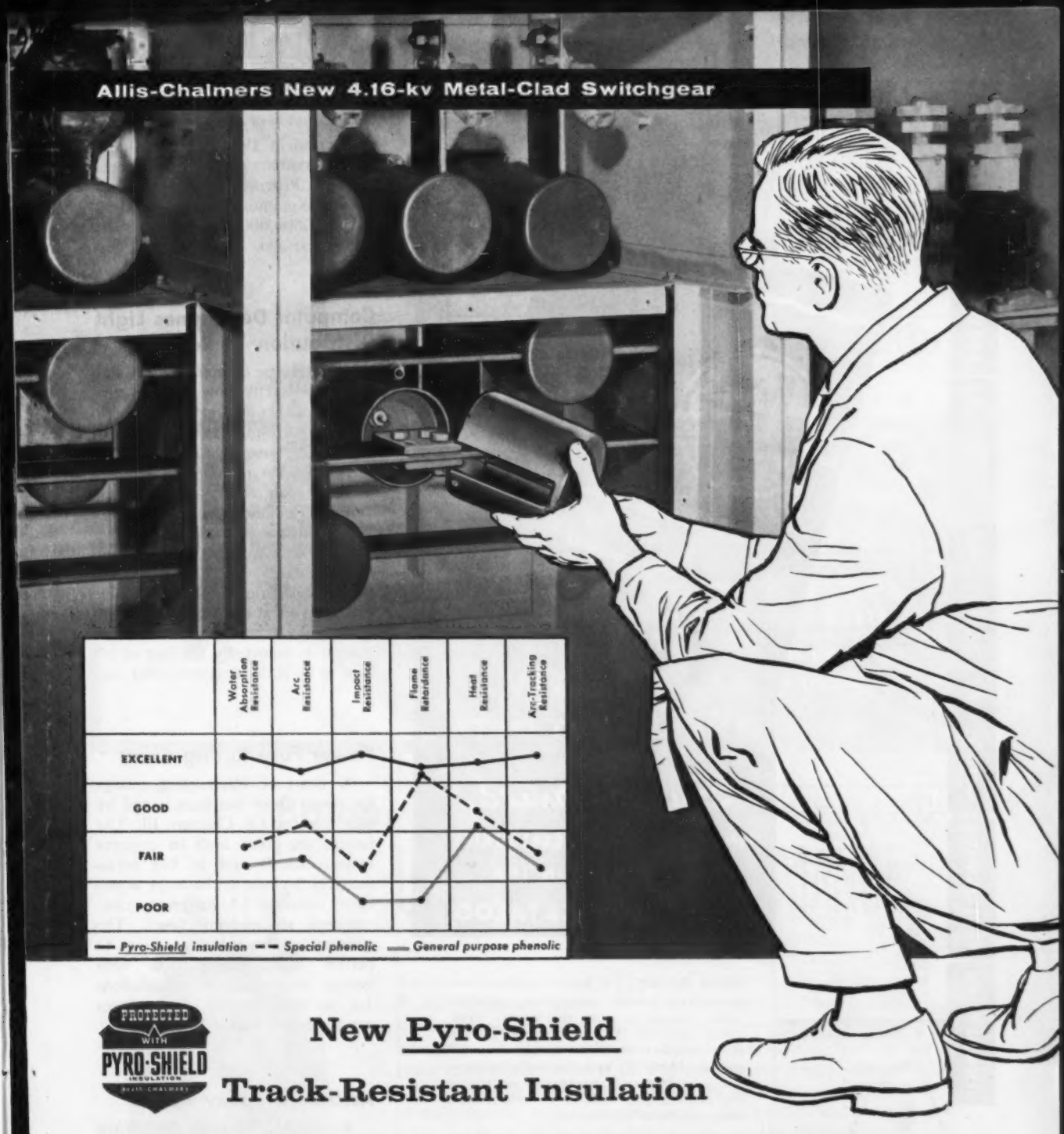


New motor development may eliminate premiums you've been paying for specially protected motors.

Electrical modernization includes placing substations close to machines being served.

ALLIS-CHALMERS

A-5150



PROTECTED WITH PYRO-SHIELD INSULATION

New Pyro-Shield Track-Resistant Insulation

Track-resistant *Pyro-Shield* insulation is a polyester glass base material now used in Allis-Chalmers coordinated system of switchgear insulation.

One molding connects primary disconnects to bus bars to provide uniform insulation and reduce the number of insulation components.

In addition to being track resistant, *Pyro-Shield* insulation has high impact strength, which eliminates risk of damage from short-circuit stress and assures low moisture absorption.

Other advantages are: high flame retardance; long life — even at high temperatures; resistance to chemical fumes; and bus joint construction that eliminates need for skilled taping techniques.

Get details on this new insulation and other Allis-Chalmers switchgear features, including the low 72-inch silhouette and new *Shelter-Clad* design. Contact your nearby Allis-Chalmers office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

For Progress in Switchgear

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Pyro-Shield and Shelter-Clad are Allis-Chalmers trademarks.

A-5862

Fanner Catalogs are known for their completeness of helpful information — selection tables, application data, step-by-step installation methods. The new Catalog EP-8 is more complete than ever before. You will see how FANNER's exclusive features, precision manufacturing, protective packaging and color coding work to advantage on a wide variety of applications.

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Westinghouse Income

(Continued from page 88)

the period in 1957, when 229,555 fewer common shares were outstanding. Provision for Federal taxes for the nine-month period in 1958 was $35,500,000 against $50,900,000 a year ago.

Computer Determines Light Distribution in Room

An analogue computer which determines exactly how light is distributed within a room has been built by Smoot-Holman Co, Inglewood, Calif. The same lighting conditions as those in the room are set up electrically inside the computer which makes calculations that determine the brightness and amount of light.

The basis working principle of the computer was formulated by Philip F. O'Brien of the University of California at Los Angeles and the S-H computer, an adaptation of this design, is reportedly the first of its type to be built for commercial use.

Power Fuse Rating Chart

A chart of interrupting ratings for power fuses has been issued by S&C Electric Co, Chicago, Ill. The ratings are given both in amperes (asymmetrical) and in kva (symmetrical 3-phase on basis of asymmetry factor of 1.6) for greater convenience in applying fuses. The symmetrical kva values are given to permit direct comparison with system short circuit calculations for locations where power fuses are applied. Request Bul. 205.

Reichhold Epoxy Resins

Reichhold Chemicals Inc, White Plains, N. Y., has a line of epoxy resins (known as Epotuf) in two forms. Liquid forms in low, medium and high viscosities can be converted into a thermosetting plastic for casting, potting, and encapsulating. Applications are capacitors and small transformers. Solid forms are used primarily for surface castings, also in impregnation of fabric and in preparation of adhesives.

There's a good reason WHY...

ALLIS-CHALMERS uses

DIGITAL COMPUTERS

in the design program for distribution transformers

Balanced design assures

UNEXCELLED PERFORMANCE

IN a continuing design program of distribution transformers, Allis-Chalmers engineers combine their technical ability with the electronic efficiency of digital computers. Working with selected values for variables and with rejection criteria, the computer facilitates selection of the best possible transformer design.

By combining engineering skill with the controlled data output of the computer, Allis-Chalmers has developed a balanced design — a design in which each feature complements the others to provide superior performance and long transformer life.

For *all the good reasons why* Allis-Chalmers distribution transformers assure unexcelled service, call your A-C man. Or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

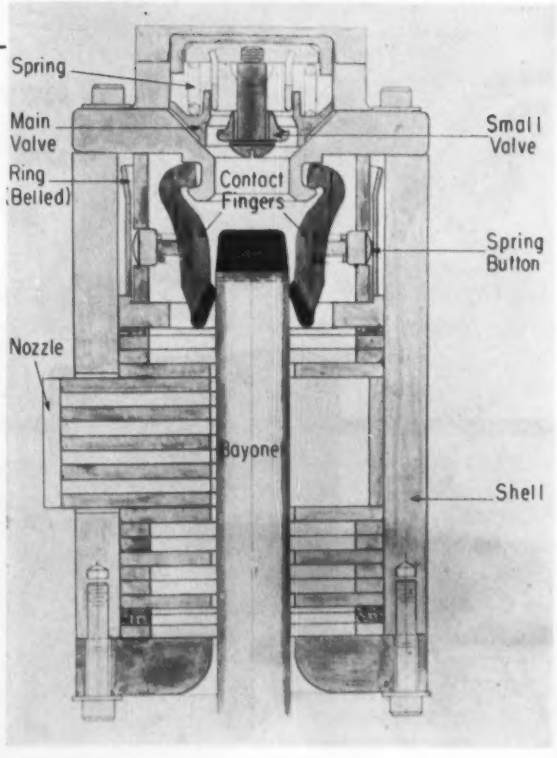
ALLIS-CHALMERS

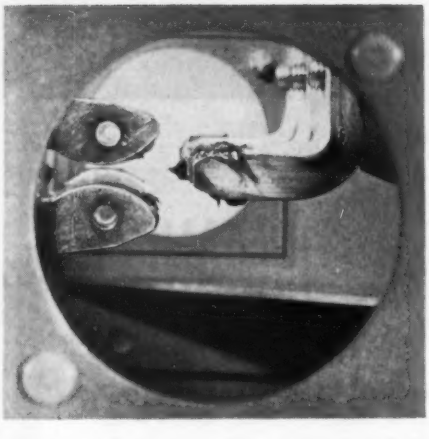
A-5724

New Equipment

Interrupting Device . . .

. . . is available for standard 23, 34.5, and 46-kv outdoor oil circuit breakers (Type FZO). Known as Type LC, the cross-blast or side-exhaust interrupter is of the suicide type. The contact structure consists of a bayonet and eight fingers in a cluster. Each finger is backed by a spring for contact assurance. The finger-cluster arrangement permits oil to flow between the fingers for more efficient cooling of the contact parts. The reduced arcing time of less than 3 cycles in all application ranges results in lower oil carbonization.
Allis-Chalmers Manufacturing Co, Milwaukee 1, Wisc.



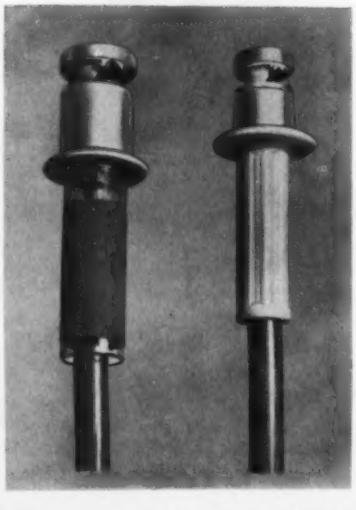


Enclosed Circuit Breakers . . .

. . . feature "visible break" design. A visual check of disconnect contacts is permitted by openings with transparent covers on the sides of the enclosure. Breakers are used for service-entrance and single-circuit requirements in commercial buildings, industrial plants, and power stations. Units are available in 225, 600, and 1,600-amp frame sizes for 600-v operation.
I-T-E Circuit Breaker Co, 1900 Hamilton St, Philadelphia 30, Pa.

Insulated Jumper Clamps . . .

. . . in two new styles are now available. Large series of clamps (left in photo) accomodates conductors ranging from 1/0 through 750 Mcm stranded copper. Regular series has wire size range of No. 6 solid through 250 Mcm stranded copper. Each type is made in four sizes to take jumper cable ranging from 4/0, 10,000-v to No. 2, 5,000-v.
A. B. Chance Co, Centralia, Mo.



(More New Equipment on page 94)

PARANITE®

3 CONDUCTOR SHIELDED CABLE

Used in Conjunction With

ENIWETOK

Atomic Tests

What is the specific application of this cable? Frankly we haven't been told; but it was precisely engineered to rigid government specifications.

Call in Paranite on your next cable problem —they've been solving them since 1890.

PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Fort Wayne 6, Indiana

MANUFACTURING PLANTS: Birmingham, Ala.; Anaheim, Calif.; Jonesboro, Ind.; Marion, Ind.; Tiffin, Ohio

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For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

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I-T-E ..... Circuit Breaker ☐
A B Chance ..... Clamp ☐
Vars Co. ..... Var Adapter ☐
Sel-Rex ..... Relay Tester ☐
G E ..... Photo Relay ☐
Westinghouse ..... Reactor ☐
Line Material ..... Ground-Trip ☐
Columbia Tech ..... Sling Pads ☐
Motorola ..... Switching System ☐
G E ..... Motor ☐

OTHER

_____

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Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

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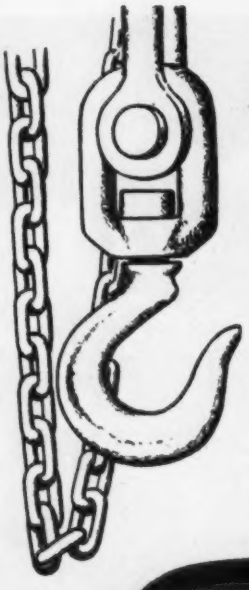
NOVEMBER 10, 1958



FORGED, *of Course!*

STRONGER
TOUGHER
LIGHTER

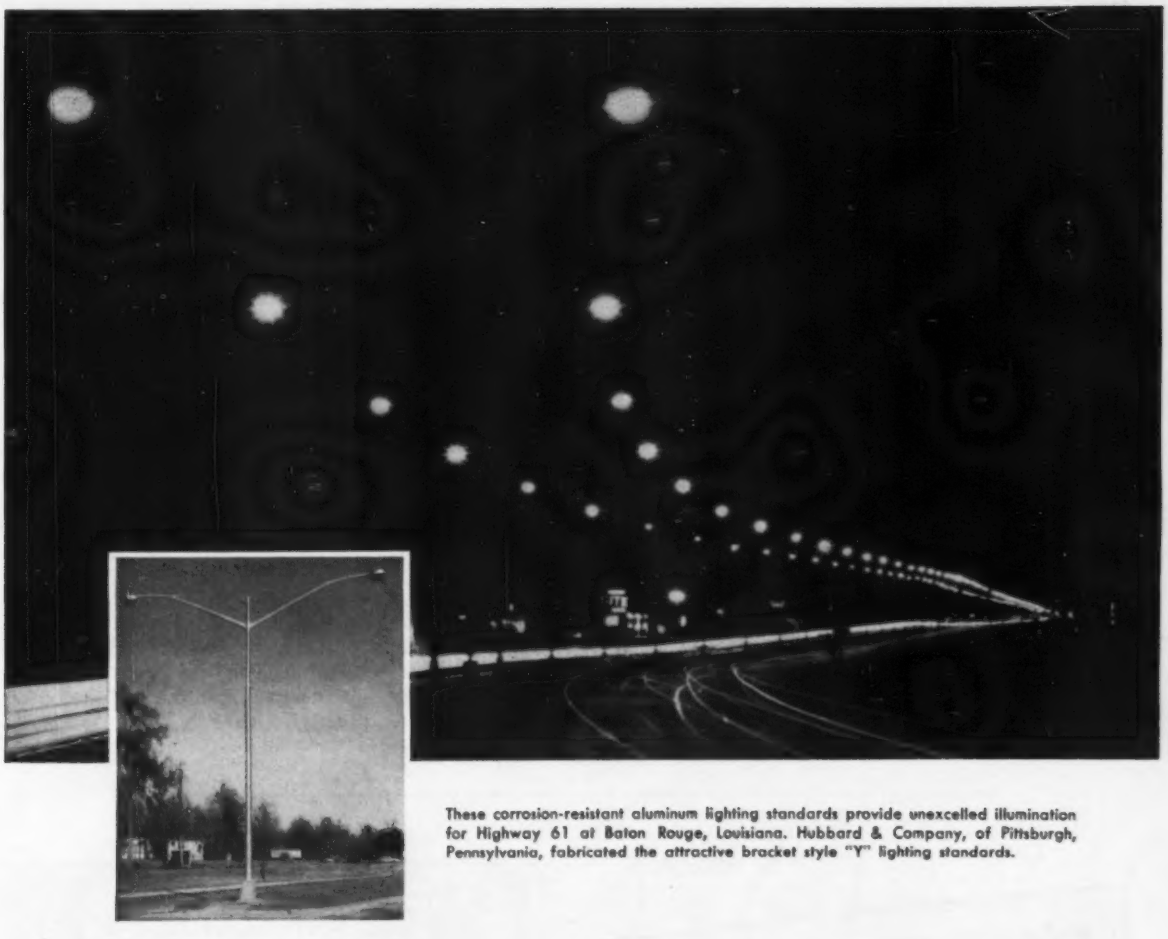
BTC

Drop Forged

STRAIN CLAMPS

Wide range of sizes • Continuous power path
Efficient, dependable dead-ending for all conductors
Easy and economical to install — no special tools
Specify the best—BTC Hi-Line Hardware

The BREWER-TITCHENER CORPORATION
HI-LINE HARDWARE DIVISION • CORTLAND, N.Y.



These corrosion-resistant aluminum lighting standards provide unexcelled illumination for Highway 61 at Baton Rouge, Louisiana. Hubbard & Company, of Pittsburgh, Pennsylvania, fabricated the attractive bracket style "Y" lighting standards.

Louisiana installs corrosion-free, maintenance-free lighting standards at no extra cost

Lighting standards of Alcoa® Aluminum are rapidly becoming the people's choice in every state of the Union. The reason? Their first cost is the last cost. Once installed, they provide years of maintenance-free service. Even under highly corrosive and moist conditions, aluminum stays new-looking longer. It can never become an eyesore; it never requires a protective coating of any kind.

Because of their light weight, aluminum lighting standards cost less to ship and handle—they install easier and faster for additional savings in construction costs. Yet, these lightweights are heavyweights for punishment. They'll stand up in hurricane winds of 100 miles per hour and more. And, because interiors stay free from accumulations of scale, they guard electrical circuits against short circuits and service interruptions.

Alcoa does not make lighting standards, but can supply you names of manufacturers who do. For these and any additional information about lighting standards of Alcoa Aluminum, write to Aluminum Company of America, 1977-L Alcoa Building, Pittsburgh 19, Pennsylvania.

WE CHOSE ALCOA ALUMINUM MILL PRODUCTS

YOUR GUIDE TO THE BEST IN ALUMINUM VALUE

ALCOA THEATRE
Fine Entertainment
ALTERNATE MONDAY EVENINGS

Wattmeter-Var Adapter . . .

. . . allows wattmeters to perform functions of varmeters and power factor meters. The Model 100 wattmeter-var adapter may be used with all dynamometer wattmeters without requiring circuit alterations. It indicates the nature of the load with regard to leading or lagging power factor; the amount of reactive volt-ampere compensation for unity power factor systems is also shown directly.

Vars Co, Box 272, Park Ridge, Ill.

Relay Tester . . .

. . . provides continuously variable a-c source. The unit tests circuit breaker relays, overload relays, circuit breakers, and other time-versus-current devices. The main output circuit provides the following continuous a-c ratings: 0-4 v @ 100 amp; 0-8 v @ 50 amp; 0-16 v @ 25 amp, with 115-v single-phase input. The secondary output circuit

is continuously variable 0-115 v. The unit is contained in a magnesium carrying case and weighs 41 lb.

Sel-Rex Corp, Nutley, N. J.

Photoelectric Relay . . .

. . . is powered entirely by transistors. Called the "Transeye", the tubeless unit will make 300 operations per min. The miniature light source and phototube holder operate at a lightbeam distance up to 8 ft. It can energize magnetic counters, conveyor switching devices, and magnetic contactors and motor starters. Additionally, it can solve materials handling problems by counting, diverting, sorting, detecting, and inspecting.

General Electric Co, Schenectady 5, N. Y.

Welding Reactor . . .

. . . widens the range of applications of CO_2 welding. By limiting the rate of rise of weld current, the reactor permits the use of lower weld currents and the transfer of weld metal in droplet form. This allows the use of larger and less expensive wire sizes, and permits effective depth control of weld penetration and the use of the CO_2 process for vertical and overhead welding.

Westinghouse Electric Corp, Box 2025, Buffalo 5, N. Y.

DANGER! CORROSION AT WORK...
IN CORROSIVE AREAS, WE USE ROZONE-ROSEAL POWER CABLE. THAT ROSEAL JACKET IS TOPS AGAINST OIL, CORROSIVE FUMES, AND MOST CHEMICALS
1
LOOK, MACK... JUST ABOUT THE EASIEST-PULLING JACKET YOU CAN GET. BENDS EASY, TOO... EVEN AT BELOW ZERO TEMPERATURES
3
WET, HOT AND MUGGY! BUT ROME'S ROSEAL JACKET CAN TAKE IT! YESSIR, WHEN WE NEED DEPENDABLE POWER IN CORROSIVE ATMOSPHERES, WE SAY ROME'S ROZONE-ROSEAL POWER CABLE
USE ROZONE-ROSEAL POWER CABLE
REFINERIES
PAPER MILLS
STEEL MILLS
WHEREVER CORROSIVE CONDITIONS EXIST
4

Ground-Trip Solenoid . . .

. . . and current transformer combination provides increased sensitivity to ground faults. Zero-sequence currents of 25 amp or more can be detected, so reclosers can protect circuits and equipment from low-current ground faults in addition to high-current, phase-to-phase faults. Tripping combinations can be all fast, all delayed, or a combination sequence can be selected. It is used with Kyle Type R and W reclosers.

Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wisc.

Protective Pads . . .

. . . for use on wire rope slings protect the load from scratching. Known as "SELA" pads, they are mounted on the rope and may be slid along the rope by hand. The pads are made of aluminum alloy with a rubber lining facing the surface of the load. The patented

"SELA" pads are made in five sizes for use on steel wire ropes from 15/32 in. to 1-37/64 in. in diameter. Two models are available: standard, for use on straight surfaces, and angle, for use on sharp edges.

Columbia Technical Corp, 61-02 31st Ave, Woodside 77, N. Y.

Switching System . . .

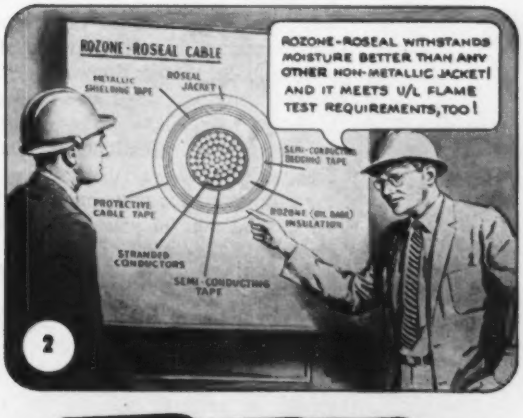
. . . provides centralized control of remote capacitor banks. Switching is accomplished through transmission of code tones by carrier to transistorized receiver-decoders located at the capacitor sites. When system voltage or reactive load measured at the substation bus exceeds preselected limits in either direction, the coder initiates action to add or remove capacitor banks from the line.

Motorola, Inc, Communications and Industrial Electronics Div, 4501 W Augusta Blvd, Chicago 51, Ill.

Rolling-Mill Motor . . .

. . . has been redesigned for greater ease of maintenance and improved dependability. New arrangement of twin-drive motors places the upper motor near the mill, with the lower motor set back. Both thrust bearings are immediately accessible. Quickly removable covers over both ends provide quick access to the motors. High-temperature resisting resins improve the stator insulation system.

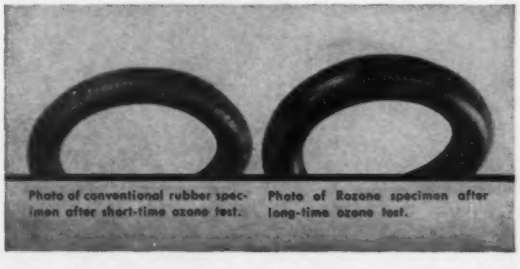
General Electric Co, Schenectady 5, N. Y.



Available in voltage ranges through 15 kv Rozone-Roseal preferred power cable may be installed in air, conduit, underground ducts, or directly in earth. Your choice of premium ozone-resistant insulations: Rozone (oil-base) or Rozone A (butyl-base). For complete information, contact your nearest Rome Cable representative and ask for Bulletin RCD-700. Or mail the coupon today.

ROME CABLE
CORPORATION

A matter of FACT



Rozone Insulation is high in dielectric and impulse strength and has excellent resistance to corona and ozone cutting.

FREE BULLETIN describes the benefits of Rome's preferred high-voltage power cables.

ROME CABLE CORPORATION
Department 719, Rome, New York

Please send me a copy of the new Rome Cable Bulletin RCD-700.

Name .....
Title .....
Company .....
Address .....
.....
Type of business .....

What Will 1¢ Buy? NSP Has Some Answers

PUZZLED CLERKS CO-OPERATE
What Will a Penny Buy?
Girl Reporter Finds Out
By STEPHANIE BROWN
YOU CAN STILL BUY THESE ARTICLES FOR A PENNY
Dear Stephanie: May we suggest any of these bargains for your penny?
Electricity's penny-cheap from
NORTHERN STATES NSP POWER COMPANY

THIS AD told readers what electricity would do for 1¢ and was produced only 24 hours after the story appeared. The power company garnered many compliments and even the ad agency scored with local rivals

A girl reporter in Minneapolis went searching recently for things a penny would buy. She went to a stationery store and got three rubber bands. She went to a hardware store and got a foundry nail, a ⅛-in. nut, a cable staple, a wall hook, and four 10-penny nails. She acquired a fish hook, a sinker, and two red golf tees. Penny candy amounted to one kiss (the milk chocolate kind), one sucker, a piece of bubble gum, and a Tootsie-roll. And she was able to weigh herself for a penny.

But the Northern States Power Co felt she had overlooked the biggest bargain available today for thrifty shoppers. For several years NSP's advertising has featured the fact that "Electricity's penny-cheap from NSP". As soon as the story appeared, in a recent issue of the *Minneapolis Star*, the utility's ad agency, Campbell-Mithun, leaped into action. Within 24 hours they had produced an ad, (shown left).

It told Stephanie Brown, the reporter, and the newspaper's readers, about 22 specific penny-bargains in electricity. Headlined, "Dear Stephanie: May we suggest any of *these* bargains for your penny?" the ad showed that "if you spend it for electricity: One penny will . . ."

. . . play 60 top tunes on a Hi-Fi set

. . . beat 600 eggs in an electric mixer

. . . keep a person hotsy-totsy under an electric blanket for six hours

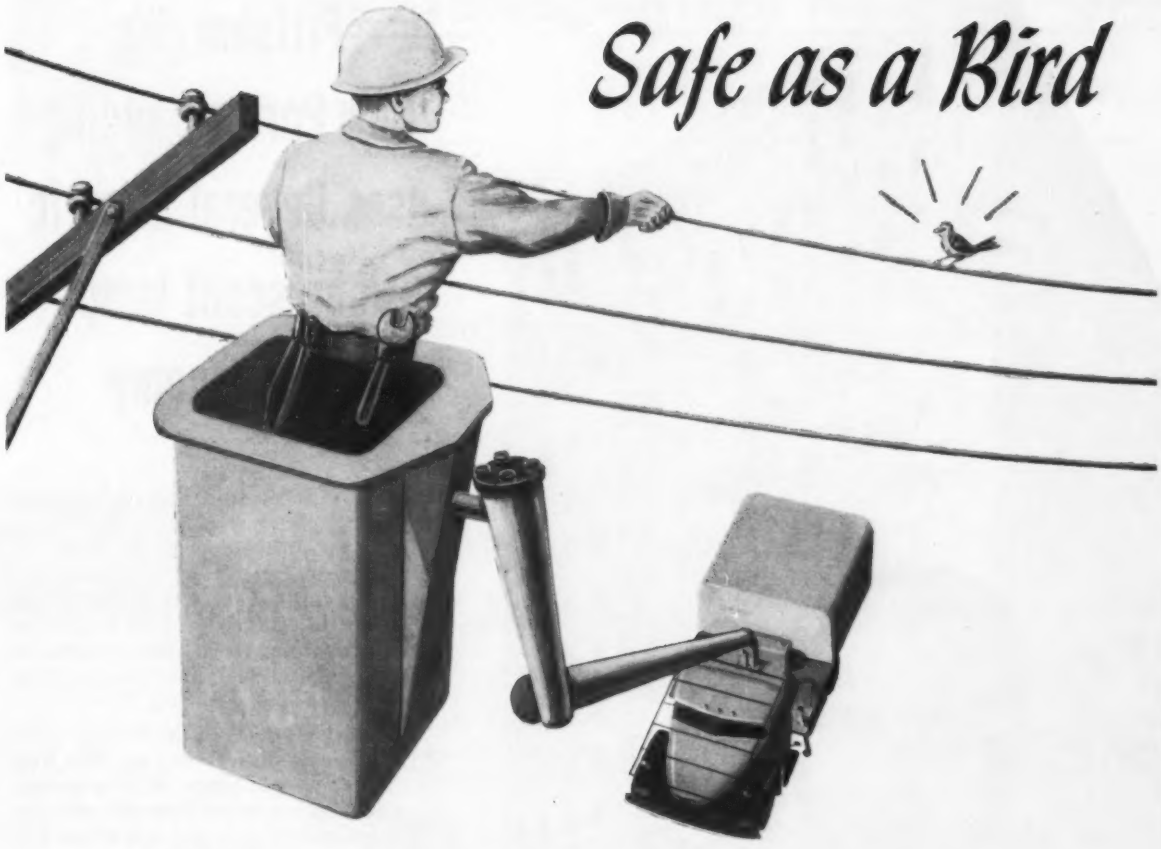
. . . give a man 200 smooth electric shaves

. . . keep a sun lamp shining long enough to give a Hawaii tan for nearly a week

. . . milk 12 cows

Results? "Phenomenal." Many customers phoned to report "everybody in our neighborhood enjoyed your ad."

Commented one official: "Nothing like this ever happened to me before during my entire 30 years with the company."



Safe as a Bird

ASPLUNDH LINE LIFT

NOW, Without Question, Your Operator Is Completely Insulated From Ground While In The Basket.

Spiralloy makes it possible — a new concept in an aerial device for the Electric Utility Industry. The outer boom of the Asplundh Line Lift is made of a material that permits working in and around energized overhead conductors *in absolute safety*. Not a shadow of a doubt as to the complete safety of your employee. He's as safe as a bird on the wire!

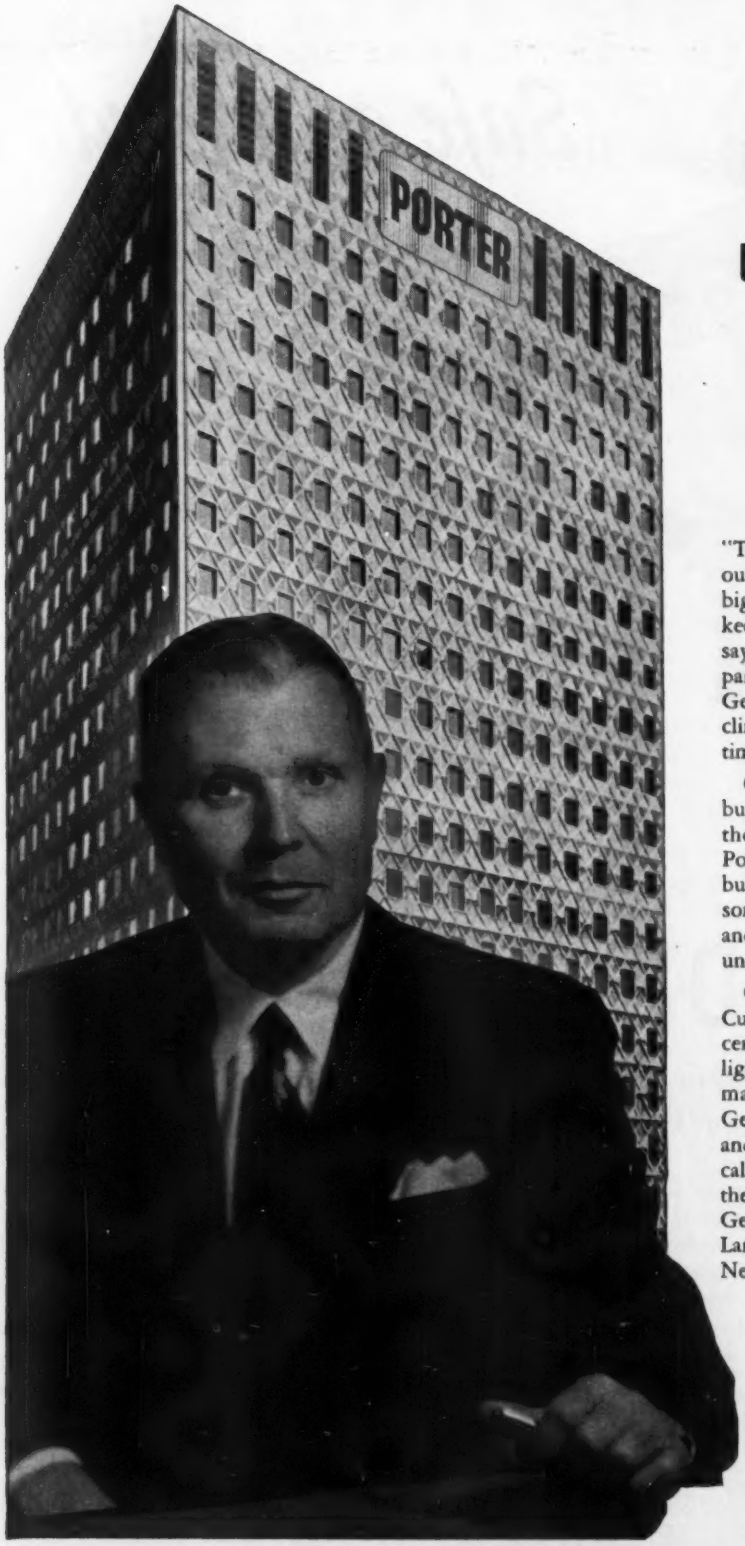
Enjoy the advantages and economies in using this aerial device with assurance and confidence. Tremendous new horizons can be conceived in methods and procedures in overhead maintenance and construction.

In addition to these outstanding benefits, the new Asplundh Line Lift offers a very simple mounting arrangement for any truck chassis of acceptable G.V.W. Four "U" Bolts secure the unit to chassis frame directly in back of the truck cab.

Write today for further information on the new Asplundh Line Lift with the SPIRALLOY outer boom.

ASPLUNDH Chipper Company

501 York Rd., Jenkintown, Pa.



Pittsburgh's New Porter Building uses General Electric fluorescent lamps for economy

"The lamps themselves are only a small part of our over-all lighting costs, so we look for the big economies that come with the lamps that keep our total lighting costs to a minimum," says T. M. Evans, Chairman, H. K. Porter Company, Inc. "In addition to these economies, General Electric fluorescent lamps contribute to climate control which creates 'eternal spring-time' in the new Porter building."

Conveniently located in the heart of Pittsburgh's business district across the street from the city's two major hotels the sixteen-story Porter building was erected faster than any other building of its kind in the city. It is tenanted by some of the best names in American industry, and has modern, up-to-date office space that is unsurpassed in Pittsburgh.

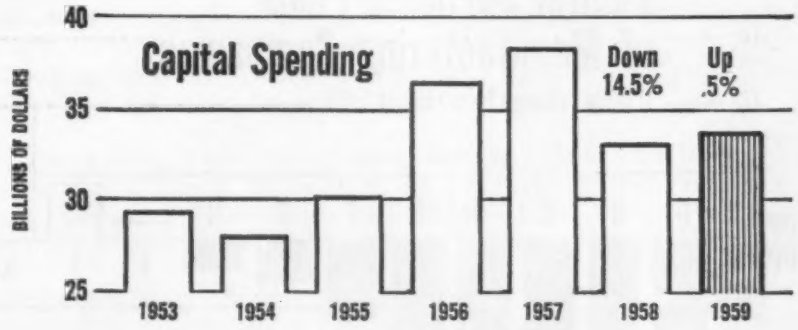
G-E Lamps are giving Porter extra value, too. Customers who have used G-E 40-watt fluorescents exclusively are getting 38 per cent more light today than they did in 1950 because of the many improvements that slip quietly into General Electric Lamps to improve light output and keep lighting systems up-to-date automatically. Call your local G-E representative and get the whole story. Or write: General Electric Company, Large Lamp Dept. C-841, Nela Park, Cleveland 12, O.

OPERATION up turn

Progress Is Our Most Important Product

GENERAL ELECTRIC

G-E LAMPS GIVE YOU MORE VALUE FOR ALL YOUR LIGHTING COSTS



Source: McGraw-Hill Surveys, Dept. of Commerce

Report on
Electrical Business Outlook

I. Capital Spending Up in 1959

Yes, business spending for new plant and equipment will be higher in 1959. It probably won't be a big plus, but overall investment will be picking up momentum as the year moves on. Most important, the trend is already up—after the sharpest cutback since World War II.

These are the findings from the latest McGraw-Hill survey of business investment plans for 1959. Highlights of the survey (which was taken in September and October) are as follows:

• **Plans now call for an increase of only .5% next year.** Advance plans for 1960 are about the same as those for 1959. But previous experience indicates that these preliminary plans will be revised upwards.

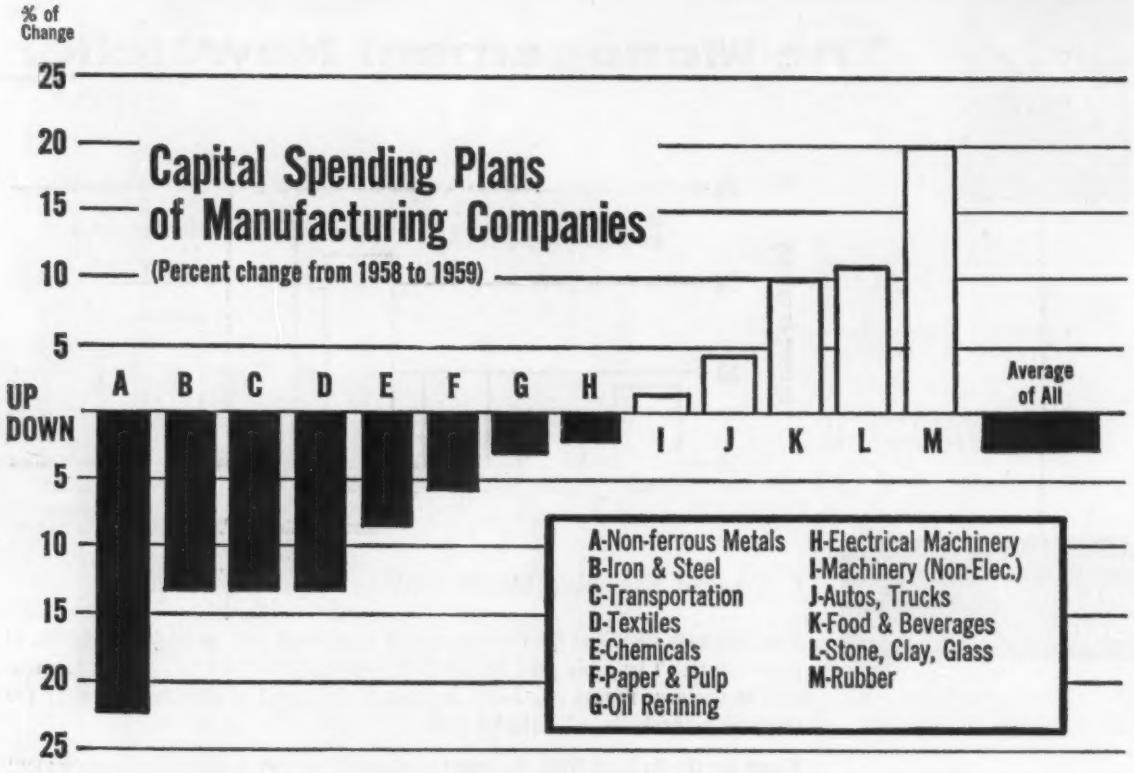
• **Current plans do not indicate an early return to 1957's peak level** of capital spending. Total outlays in 1958 are now estimated to be 15% below the $38.4 billion spent in 1957. Budgets for 1959 and 1960 would have to be increased substantially for capital expenditures to hit a new high.

• **Manufacturing companies now plan to spend slightly less in 1959** than they did this year—mainly because there is still considerable excess capacity. But the decline of only 3% is small compared with the 27% cutback this year, and subsequent revision of plans may result in an increase.

PLANS FOR CAPITAL SPENDING *(Millions of Dollars)*

INDUSTRY	1957 Actual	1958 Estimated	1959 Planned	1958–59 Change	1960 Planned
All Manufacturing	$13,647	$10,009	$9,678	− 3%	$9,655
Petroleum Industry	5,797	5,158	5,442	+ 6	5,439
Mining	450	425	376	−12	323
Railroads	1,396	751	774	+ 3	937
Other Transportation & Communications	4,604	4,141	4,275	+ 3	4,414
Electric & Gas Utilities	6,197	6,280	6,103	− 3	5,693
Commercial	7,199	6,694	6,962	+ 4	6,823
ALL BUSINESS	38,437	32,852	33,022	+ 0.5	32,661

October, 1958 McGraw-Hill Survey.



• **Non-manufacturing industries as a whole will spend more in 1959.** The petroleum industry, commercial business, railroads, and communications all have higher figures on the books for next year. These more than offset decreases planned in mining and utilities.

• **Companies in every manufacturing industry expect higher sales in 1959.** The average increase expected is 9% in physical volume.

The planned increase in investment of less than 1% is bigger than it looks. Since many companies have not revised next year's budgets, the figure has a downward bias. For example, compare the recovery from the previous recession. In the fall of 1954, business reported plans to spend 5% less on new plant and equipment in 1955. By the spring of that year, plans had been revised to show a 5% increase. And when the year was over, actual expenditures were up 7% over 1954. Capital generally lags a bit on the upturn, and this year is no exception.

II. Manufacturing Outlays Still Down 3%

Right now, the upward revision in plans is still spotty—particularly in manufacturing. About half of the major industries (see chart above) plan an increase. But no manufacturing industry has brought either its 1959 or 1960 budget back to the record level in 1957.

Electrical manufacturers plan to spend 2% less in 1959, compared to this year's cutback of 14%. This is less of a decline than for all manufacturing. And preliminary 1960 budgets for electrical companies already call for a strong 15% increase. As a sub-group, appliance outlays are now scheduled to go up 27% next year, another 13% in 1960.

Detroit has upped its spending plans by 4% for 1959, following a heavy 39% slash during the recession. Machinery and other metalworking companies plan to spend about the same next year as in 1958.

Chemical processing industries as a whole still have the brake on. Chemical companies plan to spend 8% less next year, paper and pulp 6% less and petroleum refining 3% less than in 1958. The two bright spots in this area are rubber companies (up 20%) and the stone, clay, and glass industry (up 11%). This year, the cutbacks in processing industries ranged between one-fifth for chemicals and one-third for rubber.

Capital spending in food and beverages will be up 10% in 1959. But textile companies—despite the fact that sales are perking up—still don't seem to be very optimistic about next year's prospects. Outlays are down again after a heavy 35% reduction in 1958.

Basic metals are still the weakest sector in capital expenditures. Iron and steel will be down 13% in 1959, non-ferrous metals down 22%. A heavy dose of excess capacity has pushed virtually all expansion plans into the future.

III. Strength in Non-Manufacturing Industries

The real strength in capital spending comes from non-manufacturing industries. As a group, they already plan to spend $23.3 billion in 1959—up 2% from this year's level. Unlike manufacturing, preliminary plans for 1960 already exceed the 1958 figure of $22.8 billion. Thanks to utility outlays, the decrease this year was far less than in manufacturing.

As expected, utility spending next year won't match the 1958 record. Investor-owned companies in the McGraw-Hill survey plan a decrease of 4% next year, and preliminary plans for 1960 are off another 8%. Outlays in 1958 fell a bit short of last spring's budgets—but were still up 4% to $3.8 billion.

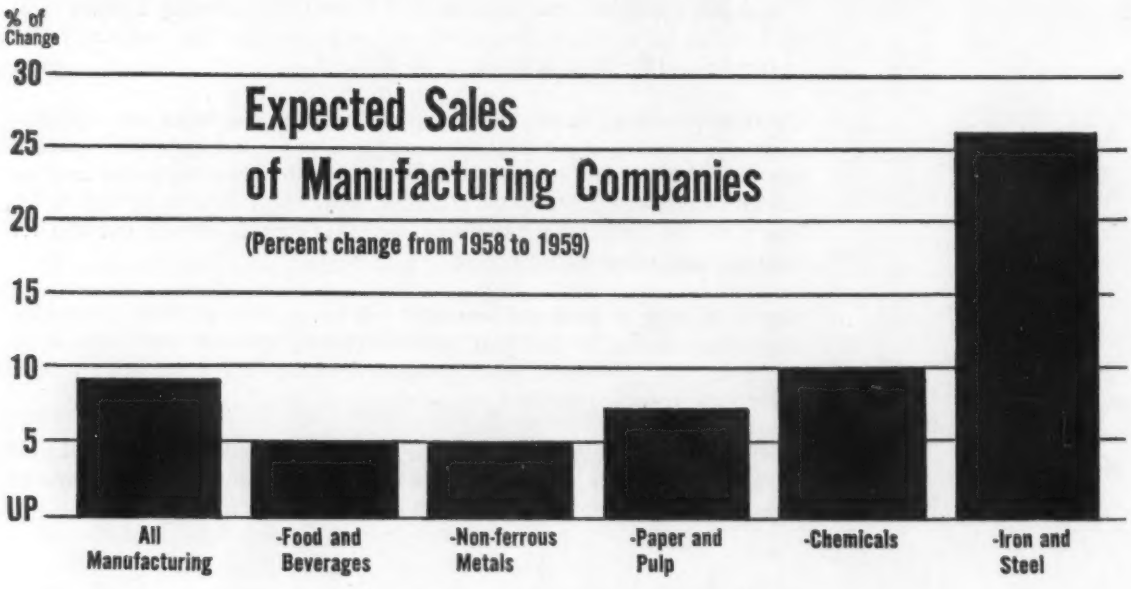
Oil companies plan the largest increase in spending next year—up 6% over 1958. Most of the rise will be in production, ie., oil well drilling. Moderate reductions are planned for transportation (including oil pipelines), marketing and refining. Plans for 1960 call for $5.4 billion—about the same as 1959.

Commercial firms report a 4% increase for 1959. In the past, the McGraw-Hill survey has been an accurate guide to the plans of large chain stores, banks and insurance companies for large-scale commercial construction. Small stores and service establishments are not covered in the sample. But the overall trend in commercial investment hints at a good year for small electric light and power loads.

IV. A Robust Sales Increase in 1959

Manufacturing companies see a substantial pick-up in 1959 sales, according to the McGraw-Hill survey. On the average, companies expect sales (in physical volume) to be up 9%. With some price increases, the rise in dollar sales will be even greater.

Iron and steel are banking on the largest sales jump—up 26% over 1958. Auto companies look for a 20% rise in unit sales. Other industries with expectations higher than the 9% average are chemicals—up 10%; rubber, stone, clay and glass up 11%. Generally speaking, the heavy power using industries look for considerable growth in 1959.



Electrical manufacturers plot the sales increase at about 5% over 1958. The softest spot is in heavy apparatus sales because of the slump in new generating equipment. But appliances are expected to show a 10% gain—which ties into the stronger housing market and rising disposable income expected next year. Electronic sales are also back on a strong growth trend—thanks to defense orders, sustained industrial research spending and the emphasis on modernization expenditures throughout industry.

V. Excess Capacity Still a Drag

Most industries still have substantial margins of excess capacity, despite the sharp recovery in production since last spring. A special survey conducted by the McGraw-Hill Dept. of Economics showed that manufacturing capacity is now about 50% greater than in 1950. The Department estimates that the average operating rate won't reach 80% of capacity until the end of 1958—compared to a preferred rate of 90%. Past experience indicates that there will not be much pressure to add new capacity until production moves into the 85%-90% range.

Meanwhile, the emphasis will be on heavy modernization outlays. According to McGraw-Hill estimates, the cost of replacing obsolete facilities in manufacturing would be nearly $35 billion. Add to this, $5.3 billion for petroleum, $18.4 billion for transportation and communications, $12 billion for gas and electric facilities and $25 billion for finance, trade and service. The total cost of modernizing all industry would be $95 billion. Industry is now stepping up its efforts in this area.

More than ample capacity explains the cutback in utility capital spending. Gross margin over this winter's peak will be in the neighborhood of 28%. This isn't as high as it looks (because of growing summer peaks). But it will take a few years to get winter margins back down to the ideal level. Over the next year or so, modernization will play the major role—perhaps along the lines suggested in some detail in October issues of Electrical World.

ONE BIT FITS BOTH

1. Hand Brace

2. Electric Drill

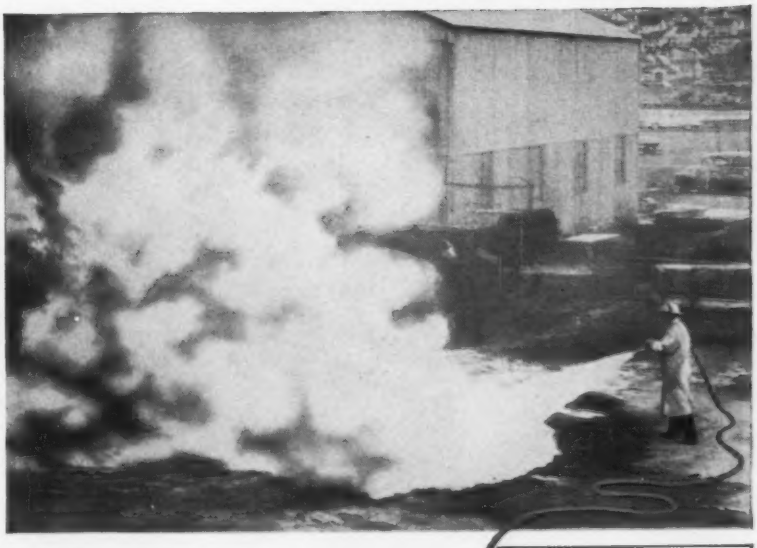
New Irwin Adapter Shank Wood Bit

Now you can eliminate the need to stock two types of wood auger bits. Irwin's new Adapter Shank Bit fits both hand braces and power drills.

With hand braces, use the Adapter Shank Bit as it comes. Cut off taper square and the Adapter Shank, with its 6 "hex flats", chucks perfectly in power drills or hand braces, either one. No wobble, no run-out. Clean, efficient cutting action. Reduces inventory and record keeping by 50%. Saves time on the job, too. Call your distributor, or write today for complete information. Sizes 4/16" to 17/16", both solid center and single twist types.

***All Irwin Adapter Shank Wood Bits** are forged in one piece from special steel and heat tempered full length for longer life. Plastic coating on balanced cutting heads guarantees factory-fresh sharpness, unequalled performance. Widely used by utilities, electricians and construction workers.*

IRWIN auger bits • screw drivers
Wilmington, Ohio



NEW!

One-Man Dry Chemical Kills More Fire Faster!

This new Kidde pressurized 200-pound extinguisher gets *more* fire-smothering dry chemical on a blaze *faster!* Its universal nozzle discharges a dense 40-foot stream that gives more efficient extinguishing action, greater heat protection for operator.

It has an *extra* 50 pounds of dry chemical to discharge on any stubborn blaze. Not 150 pounds, but a full 200 pounds of dry chemical – a 33⅓% bonus for safety! Yet its total weight is less – no heavy, cumbersome gas cylinder.

It's faster to operate too. No valves to unscrew. No wait for pressurization, for dry chemical to fluff. No pressure reducer to malfunction. Just remove safety pin, swing valve toggle, and flip "on-off" nozzle lever. There's no hose whip either.

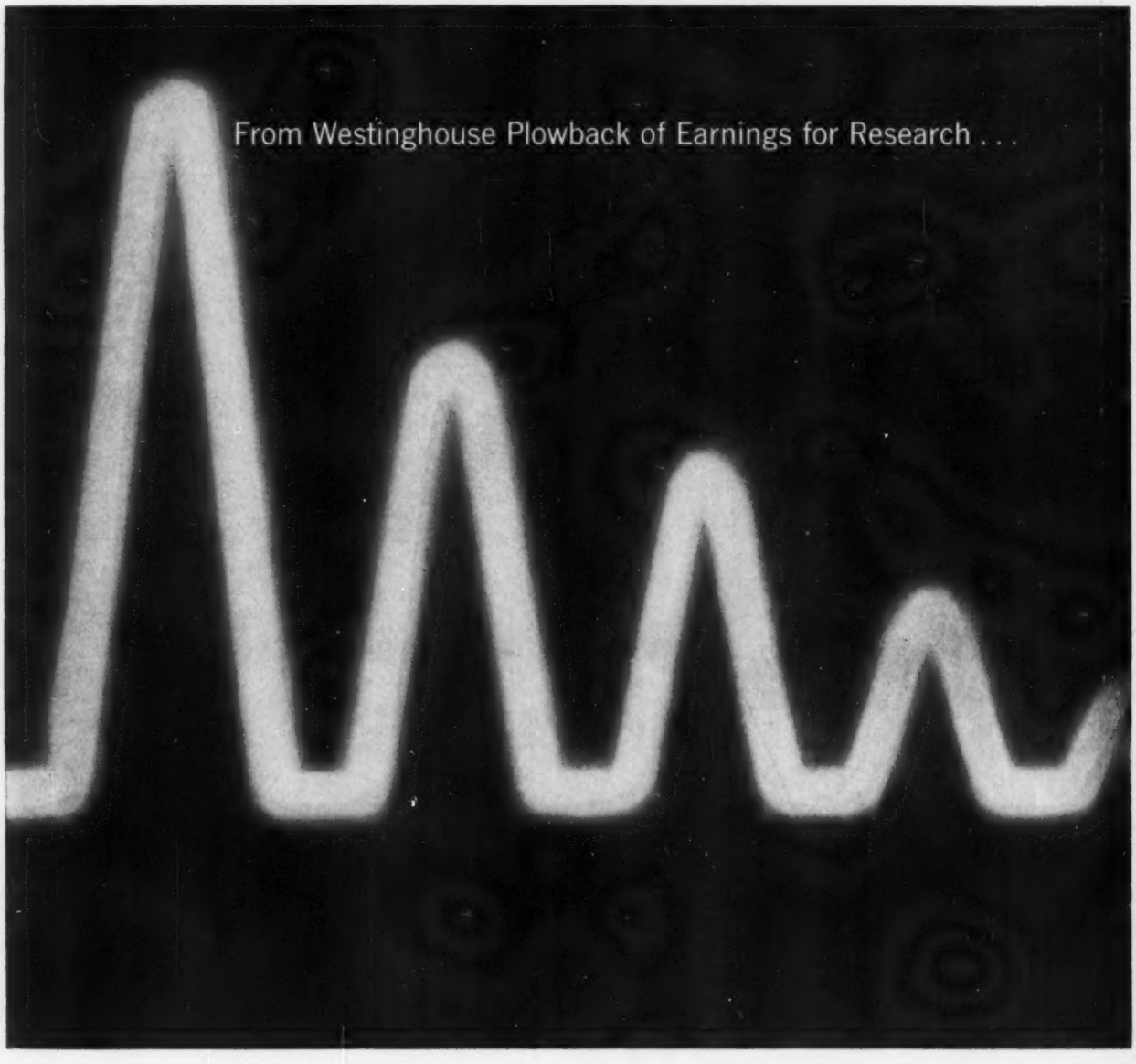
Only Kidde has the Bridgeman seal head assembly. When pressurized at 450 psi with nitrogen or *dry* air, an inner force of three tons acts on the seal – the more pressure, the tighter seal. Virtually leakproof, tamper-proof.

Check these other benefits. A low, balanced center of gravity, wider handle, compact design, and larger, lubricated wheels make it easy to move. It's weather and corrosion protected. And the shielded dust-and moisture-proof pressure gauge tells at a glance this extinguisher's readiness for action.

Write Kidde today and get the full story on this new U.L.-approved One Man Fire Engine.

Kidde (K Kidde)

Walter Kidde & Company, Inc.
1130 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd.
Montreal—Toronto—Vancouver



A new measure of high-speed *differential protection* for transformers

In the new Type HU variable percentage differential relay with second harmonic restraint supervision, Westinghouse now offers more complete and reliable protection than ever before available for two-or three-winding transformers.

Restraint supervision, on second harmonic only, prevents false trip-outs on inrush currents. The relay does not restrain on third harmonics, thus providing full protection against heavy internal faults. The variable percentage operating characteristic eliminates the need for sensitivity taps on the relay, yet provides sensitive detection of light internal faults and ample restraint for heavy external faults.

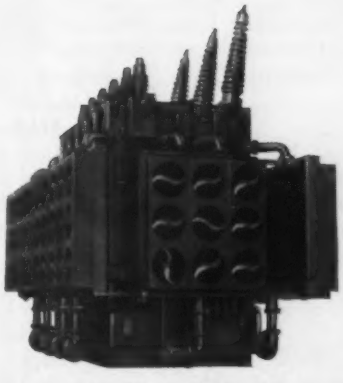
Two high-speed polar-type units in the HU relay provide simplified operation: (1) a differential unit to distinguish between internal or external faults; (2) a

harmonic restraint supervising unit to distinguish between inrush and fault currents.

The harmonic differential units will operate in 1.5 to 2.5 cycles; and the instantaneous trip unit will operate in ¾ cycle for heavy internal faults. The relay has low burden, requiring about three volt-amperes at tap value current. Built-in ratio taps compensate for mismatch of line current transformers on both two-and three-winding applications.

Adequate transformer protection is also provided during reduced frequency operation, such as exists during the generator warm-up period.

For further details about HU relay transformer protection, call your Westinghouse sales engineer or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-40504



Type HU relay protects two-winding transformers; HU-1 for use with three-winding transformers

YOU CAN BE SURE...IF IT'S

Westinghouse

News About People

CEMA Elects Turner President

W. I. Turner, president of Canadian Controllers Ltd, has been elected president of the Canadian Electrical Manufacturers Assn.

He spent the first few years of his career as a sales engineer in Pennsylvania, then joined Railway & Power Engineering Corp in Toronto as a sales engineer specializing in motor controls. In 1933, he was put in charge of a factory assembling controls. He then advanced to assistant general manager and a director of the company, a directorate he still holds.

In 1948, Railway & Power's associated company, Canadian Controllers Ltd, took over active manufacturing, with Turner as vice president and general manager. Five years later he became president.

He has been a first vice president of CEMA and the first chairman of the organization's Market Development Council.

Hickman: Section Chairman

G. K. Hickman (center) new chairman of the Electric Operating Section of the Wisconsin Utilities Assn receives the gavel from F. J. Kripps (left) retiring chairman. New vice-chairman F. W. Nolte looks on.

Hickman is with Wisconsin Electric Power Co as a transmission engineer; Kripps is resident engineer with Northern States Power Co; and Nolte is with Wisconsin Public Service Co.

The occasion was the annual meeting of the association in Milwaukee on Oct. 15-17.

PERSONAL BRIEFS

Illinois Power Co has named **John B. Burdick** assistant treasurer, replacing **Frank G. Sutherland,** retired.

Citizens for TVA, Inc, has reelected **Mayor C. L. Beard** of Sheffield, Ala., president. **Louis Wise** of Columbus, Miss., has been reelected vice president and **Stanton Smith** of Nashville, Tenn., secretary-treasurer.

Standard Engineers Society has announced the award of Fellowships to four of its members: **Vernon L. Cox,** manager of the laboratories department, Switchgear and Control Division, General Electric Co, Philadelphia; **Leo B. Moore,** associate professor of industrial management, Massachusetts Institute of Technology; **Madhu S. Gokhale,** coordinator, Military Drafting Standards, Radio Corp of America, Camden, N. J., and **S. P. Kaidanovsky,** consulting engineer, Lakewood, N. J.

G. M. Crow, Liberal, Kansas, has been named Eastern Division Manager for Western Light & Telephone Co at Harper. **F. V. Moffett,** manager of the Phillipsburg district, has been assigned as manager of the Liberal district, replacing Crow. **Dale Reeves,** line foreman in Phillipsburg, has been promoted to manager of the Phillispsburg district, replacing Moffett.

Hardie W. Beck has been appointed general manager of the Pittsburgh plant of Joseph T. Ryerson & Son, Inc, succeeding **Arthur L. Petersen** who is retiring.

American Society of Industrial Designers has elected **Donald L. McFarland** who is manager of industrial design for General Electric Co, housewares and radio receiver division, president for the year 1958-59.

(*More News About People p.* 112)

For multiple circuit street lighting . . .

THESE 9 ADVANTAGES MAKE KW® ALUMINUM CABLE YOUR BEST BUY!

- **Lighter weight than copper for equivalent current-carrying capacity**
- **Light weight simplifies installation handling**
- **Light weight reduces shipping, handling costs**
- **Easy to bend, form, train and cut**
- **Simple to splice, tap and terminate**
- **Lower overall cost per foot**
- **Excellent resistance to weathering**
- **Excellent flex characteristics**
- **Backed by 68 years of cable and insulation know-how**

To offer utilities greater cable values than ever before, KW has brought its pioneering development in aluminum conductors together with the 68 years proved experience of "the masters of insulation" (formerly U. S. Rubber Wire and Cable division).

For multiple-circuit street lighting systems, KW recommends the constructions described at right. And for wire and cable to fill any utility requirement, call on KW specialists through your KW distributor or Kaiser Aluminum Sales Office.

Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, Calif.; *General Sales Office*, Palmolive Bldg., Chicago 11, Ill.

KAISER ALUMINUM

IF IT CARRIES CURRENT, KW CARRIES IT!

SEE "MAVERICK" • SUNDAY EVENINGS, ABC-TV NETWORK

Power Supply Cables—Aluminum Conductor

Single or multi-conductor cables, stranded aluminum, sizes 4 AWG and larger, up to 15 KV, shielded or non-shielded.

Specification No. 838-S
Hydrosec® insulation—Neoprene jacket.
For wet or dry locations up to 75° C. Type USE, Style RR, up to 600 volts.

Specification No. 831-S, up to 15 KV
Kalzone insulation—Neoprene jacket.
For wet or dry locations up to 90° C.

Pole and Bracket Cables—Aluminum Conductor

For use in circuits where voltage between conductor and ground does not exceed 600 volts. Sizes 8, 10 and 12 AWG, 7 strand aluminum.

Specification No. 819-S
Street lighting cable, Neoprene type,
Figure 8 Ziplite construction.

Specification No. 820-S
Performance insulation—weatherproof braid.

Specification No. 838-S
Hydrosec® insulation—Neoprene jacket. Type USE, Style RR.

Specification No. 202-S
Type UF Cable, PVC insulation—PVC jacket.

Specification No. 942-S
Laytex® insulation—Neoprene jacket,
Figure 8 Ziplite construction.

Now is the time to DODGE

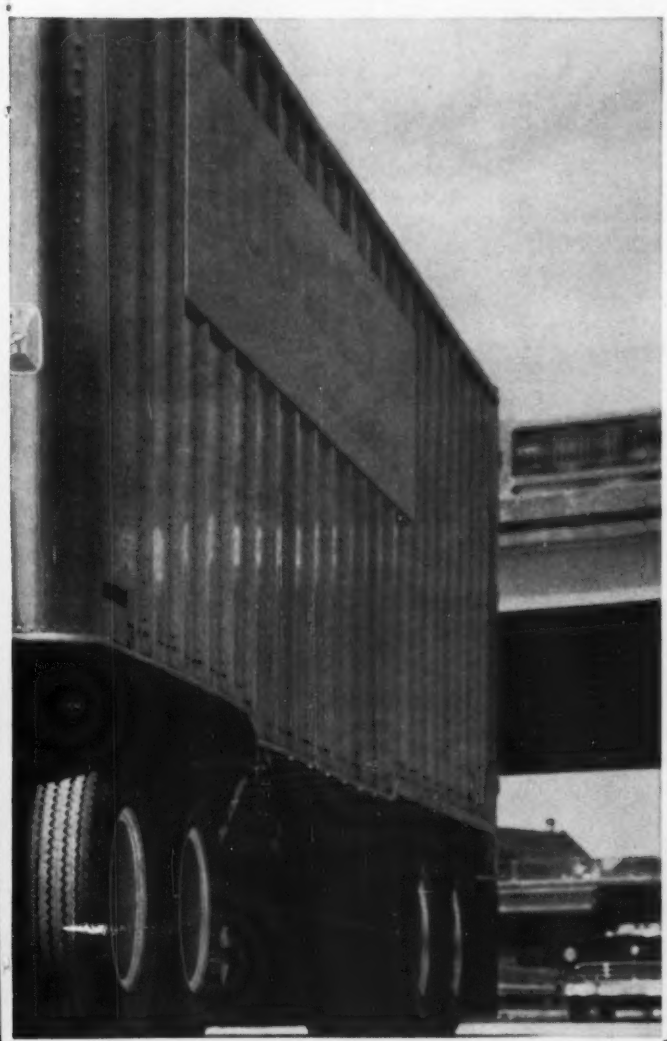
New '59 Dodge Power Giants, "Job-Rated" for

CONVENTIONAL Models 400, 500, 600, 700, 800, 900—G.V.W.'s to 30,000 lbs.; G.C.W.'s to 65,000 lbs.

TANDEM Models T700, T800, T900—G.V.W.'s to 49,000 lbs.; G.C.W.'s to 65,000 lbs.

C.O.E. Models C500, C600, C700—G.V.W.'s to 25,000 lbs.; G.C.W.'s to 50,000 lbs.

drive the new 1959 *Power Giant*



CHANGES . . .
WHERE THEY COUNT!
New performance!
New comfort!

Look into the cab—look into the chassis! Wherever you look in the new 1959 Dodge trucks, you'll find changes that *mean something*. New convenience, for instance, in suspended brake and clutch pedals, and hydraulically operated clutch. New heavy-duty electrical system. Greater dependability. Increased G.V.W.'s on tandems. Concealed running boards on medium-tonnage models.

You'll find new cab comfort, too, and better heaters. Plus new instrument panels designed especially for medium- and high-tonnage requirements.

Ask your dealer about all the new Power Giant advancements. And about the new network of Dodge Truck Centers that let him give quick delivery of any Dodge truck to meet your exact needs. Plus hurry-up parts service. See him soon!

★ ★ ★

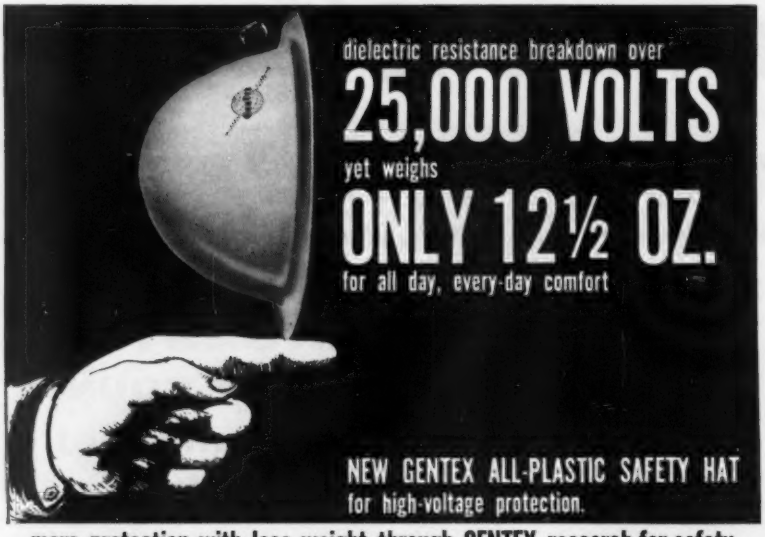
Striking new Dodge low-tonnage models! This spirited new Sweptline Pick-up leads a complete line of new 1959 Dodge low-tonnage trucks. Advanced models for every need, from 5,100 to 10,000 lbs. maximum G.V.W.

every trucking need

4-WHEEL-DRIVE Models W100, W200, W300, W300M, W500—G.V.W.'s to 20,000 lbs.

FORWARD-CONTROL Models P300 and P400 G.V.W.'s to 15,000 lbs.

TODAY . . .
IT'S REAL SMART
TO CHOOSE DODGE
POWER GIANTS



more protection with less weight through GENTEX research-for-safety

Far exceeds all Government standards and E.E.I. specifications for rugged, safe protection — made of GENTEXITE plastic. No holes, bolts, rivets or metal in crown, brim or sling to create electric shock hazard.
MEN LIKE ITS COMFORT • THEY WEAR IT. Permanent non-wrinkle headband. Instant snap-in, fingertip-adjusting washable head-cradle sling. Handsomely styled in green, gray, white, yellow, blue.

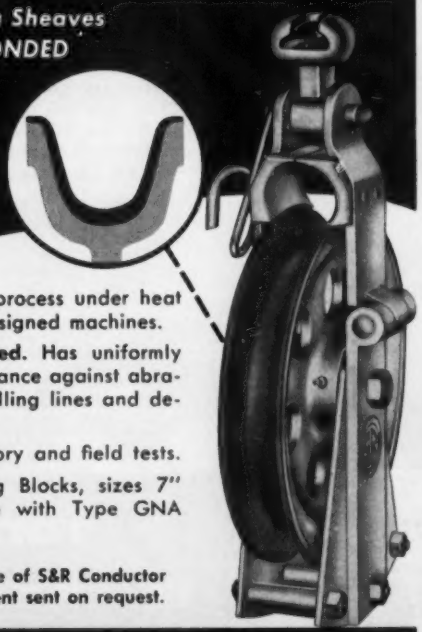
YOU CAN BET YOUR LIFE ON A GENTEX

Send today for a test hat and full specifications
Ask about our lightweight, washable winter liners.
WORLD'S FOREMOST MANUFACTURER OF HELMETS FOR THE MILITARY

GENTEX CORP. Dept. W, 450 Seventh Ave., N. Y. 1, N. Y.

Now, Conductor Stringing Sheaves WITH PERMANENTLY BONDED

TYPE GNA NEOPRENE LINING



Molded by a vulcanization process under heat and pressure on specially designed machines.

Lining is **permanently bonded.** Has uniformly excellent properties for resistance against abrasive wear from wire rope pulling lines and deterioration from lubricants.

Proven by extensive laboratory and field tests.

All S&R Conductor Stringing Blocks, sizes 7" through 28", are available with Type GNA Neoprene Lined Sheaves.

NEW CATALOG on complete line of S&R Conductor Stringing Equipment sent on request.

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ENGINEERS AND MANUFACTURERS
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E. H. van Someren Greve has been named sales engineer in the New York Office of Riley Stoker Corporation.

A. J. Zoth has been named secretary of the Pittsburgh Standard Conduit Co. He also retains his former capacity as company treasurer.

Roland Whitehurst, vice president of the Electric Storage Battery Co, has retired.

General Electric Co has made these recent appointments: **John R. Casey,** manager of user industrial sales for New England; **Richard W. Morefield,** manager—merchandise sales; **J. Stanford Smith,** general manager of the outdoor lighting department in Hendersonville, N. C.; **Joseph T. Bailey,** general manager of the general purpose control department at Bloomington, Ill.

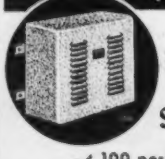
Eugene W. Commery, supervisor of residential lighting applications for the General Electric Co's large lamp department, retired recently.

Appointment of **E. S. Evans** as engineer-in-charge, project section, and R. E. Ferber, supervisor, production planning section, has been announced by Allis-Chalmers Manufacturing Co's steam turbine department.

Philco Corp has named **Roger S. Drew** as assistant to James J. Shallow, general manager-merchandising.

Howard Scott, chief metallurgist of the Westinghouse Research Laboratories, has been awarded the com-

ADD-A-PHASE
POWER CONVERTER



Operates 3 Phase Motors from SINGLE PHASE!

✓ 100 percent Rated Load
✓ High Power Factor
✓ Balanced Currents

write for free catalog

SYSTEM ANALYZER CORP.
Nokomis, Ill.

Coal hoppers, chutes and liners are among the many applications in which USS "T-1" Steel has greatly increased service life.

How to **beef-up** your equipment without adding fat

Build it stronger, tougher and lighter with USS "T-1" Steel plates. This remarkable steel was developed especially to meet the need for bigger machines and stronger, more durable equipment, built larger but with lighter components.

"T-1" Steel's greater strength reduces weight. Furnished quenched and tempered to 100,000 psi minimum yield strength, USS "T-1" Steel plates permit designers to reduce the thickness of steel used for water turbine cases, penstocks, transformers and many supporting structures. Weight reductions of 25% to 50% are possible. This in turn cuts freight and welding costs and reduces foundation requirements. USS "T-1" Steel plates can still be furnished to 90,000 psi min. yield strength and 105,000 psi min. tensile strength to meet the requirements of ASME Code 1204-3.

"T-1" Steel lengthens service life. For maximum resistance to impact abrasion, USS "T-1" Steel is furnished quenched and tempered to 321 minimum Brinell. It is recommended for applications such as coal chutes, hoppers, pulverizer feed pipes, exhaust pipes and liners for ash collectors. Users report increases in service life up to 100% or more.

"T-1" Steel is weldable. It's unusual that a steel so strong and durable can be readily welded in the field without pre- or post-heating. This characteristic permits on-the-spot fabrication at minimum cost.

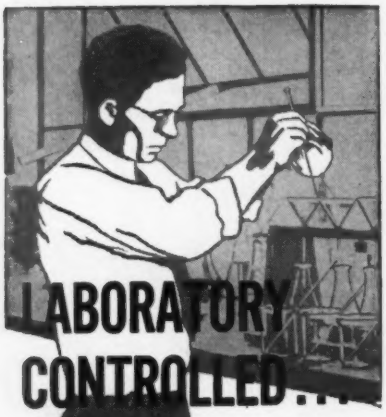
Write for free "T-1" booklet which contains design and application information, as well as helpful hints on fabrication of this versatile constructional alloy steel. United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS and "T-1" are registered trademarks

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

USS



Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

pany's highest honor, the Westinghouse Order of Merit, for his outstanding accomplishments in the development of new materials, processes, and products.

Okonite Co has named **James B. Caldwell, Jr,** manager of the San Francisco office.

Arthur J. Raymo has been appointed factory manager of the Eddystone Division of the Baldwin-Lima-Hamilton Corp.

Foster Wheeler Corp has promoted **W. L. Martwick** from senior vice president in charge of sales to president. He succeeds **Admiral Earle W. Mills** who becomes chairman. **John E. Kenney,** formerly vice president in charge of the midwest office in Chicago, has become executive vice president.

Allis-Chalmers Manufacturing Co has made these recent appointments: **Mitchell H. Russell** to assistant engineer of Pittsburgh Works; **Paul V. Houriet, Jr,** to engineering coordinator of the motor and generator department; and **J. A. Cloutier, Jr,** and **Thomas R. Herman** to assistant engineers of the nuclear pump section.

Carl D. Dimity of the Chicago office of Phelps Dodge Copper Products Corp has been made assistant vice president—sales and transferred to the New York office.

Mansfield D. Sprague has been elected vice president for public and industrial relations of American Machine & Foundry Co.

John T. O'Rourke has been named assistant vice president of Anaconda-Jurden Associates, Inc.

James H. Richardson has been appointed manager of the product development department for the Wickwire Spencer Steel Division of Colorado Fuel & Iron Corp.

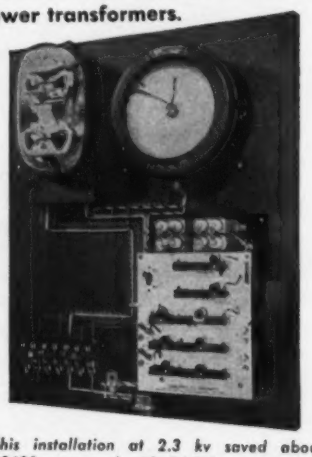
George Beuttner has been made chief chemist for Rockbestos Products Corp.

Loy Collingwood has been appointed assistant general sales manager, Riverside-Alloy Metal Division of the H. K. Porter Co, Inc.

Transformer Loss Compensator

Saves you Money!

BECAUSE it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the power transformers.



This installation at 2.3 kv saved about $2600 compared with 34.5 kv metering; it saves about $5500 over metering at 69 kv.

THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced in two and three element types for use with two-element or three-element meters on any type circuit.

Some of the Users . . .

Phila. Electric Co. Penna. Power & Light Co. Texas Power & Light Co. U. S. Bureau of Recl. Public Service Co. of New Hampshire. Utah Power & Light Co. Northern States Power Co.

Get your book now FREE

Detailed information on operation, installation, applications. Write for Bulletin NO. 63-A.

EASTERN SPECIALTY CO.

PHILADELPHIA 40, PA.

Sales Assignments

COMPANY STAFFS

Crouse-Hinds Co has made these recent appointments on the West Coast: W. C. Schaefer has been promoted to regional manager of the San Francisco region with headquarters at 370 Brannan St. He succeeds W. R. Major, Jr, who has been transferred to Atlanta, Ga. W. G. Bullock, product engineer, has been transferred from Los Angeles region to Seattle, replacing Schaefer. John W. Adams has been transferred from the New York region to Los Angeles as product engineer.

Radio Corp of America, Electronic Data Processing Division, has named John E. Johnson manager of the marketing department.

Elliott Co has appointed K. M. Grover district manager in Buffalo.

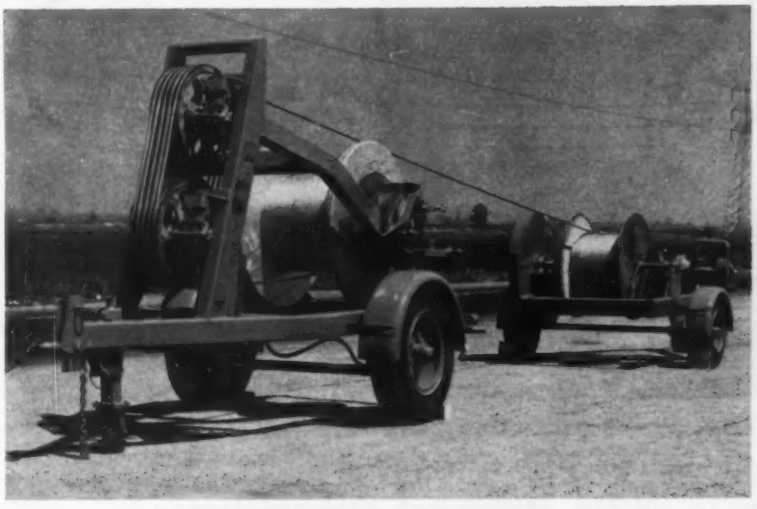
S & C Electric Co has made these appointments to the field sales staff: W. C. Milks has been named sales engineer for western Missouri, Kansas, and Oklahoma, with offices in Kansas City at the Central Sales Division office, 406 West 34th St, Kansas City 11, Mo. D. S. Sleeman, formerly with S & C Electric's home office in Chicago, has joined T. E. Palmer in Cleveland as a sales engineer.

Anderson Electric Corp has promoted John B. Rogers to product manager, Distribution Division. He will supervise the sales throughout the country of Anderson's overhead distribution equipment.

Elliott Co has announced that L. A. Wells, formerly its district manager in Milwaukee, has been named Crocker-Wheeler industrial motor sales manager in Chicago. L. E. Rau, Buffalo district manager since 1951, has been appointed Crocker-Wheeler industrial motor sales manager in New York City. R. W. Fox has become central region manager with offices in Cleveland. M. C. Seeman has succeeded Fox as Cleveland district manager.

Bucyrus-Erie Co has appointed Lewis C. Black manager of domestic sales.

Available Now for Immediate Delivery



PENGO 5000-STR-1 combination tensioner and reel dolly (foreground) has Neoprene-lined bullwheels to take conductor sizes up through .96" (556,500 CM), handles reels to 34"x72" weighing to 5,000 lbs. PENGO 5400 CP-TR Cable Puller (at rear) pulls directly onto reel. It is rated at speeds up to 3 m.p.h., and tensions to 1000 lbs. line pull. For heavier tensions and more positive control, the new economically-priced #5500 PENGO Bullwheel Cable Puller is now available.

...a PENGO Reel Dolly & Bullwheel Tensioner Combination FOR ONLY $3,000!

PENGO's new combination Tensioner and Reel Dolly is available for immediate shipment – permits your use NOW.

Take advantage of this experience to guide you in budgeting these units for your various areas.

Especially designed for small areas, this very economically-priced tensioner eliminates the need for a separate reel dolly – and the extra man.

PENGO offers more than 40 models of Bullwheel Tensioners and Bullwheel Cable Pullers for stringing every size of conductor!

Write today for literature

PETERSEN

G-11

ENGINEERING CO., INC.
Santa Clara, California

Please send PENGO Tension-Stringing equipment data to:

Name_____

Firm_____

Address_____

City_____ State_____

NEW IDEAS? I SURE GET PLENTY AT THE POWER SHOW. NO DOUBT ABOUT IT, BILL. I ALWAYS GET A WEALTH OF ENGINEERING INFORMATION BY TALKING TO THE EXHIBITORS' TECHNICAL PERSONNEL. AND THIS IS THE PLACE TO SEE AND COMPARE NEW, COST-SAVING EQUIPMENT.
YES, ED. WE'RE ESPECIALLY CONCERNED RIGHT NOW WITH LOWERING OUR PRODUCTION COSTS, AND SOME OF THE IDEAS I'VE PICKED UP HERE ARE GOING TO HELP DO IT.

You, too, can secure valuable NEW IDEAS at the

23rd National Exposition of Power & Mechanical Engineering

Auspices of ASME

New York Coliseum **December 1-5, 1958**

Register in advance by writing the exposition at 480 Lexington Avenue, New York 17, N. Y.

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"VOLT-TELLING STATISCOPE" protects worker

. . . when held in any alternating electrical field. Indicates presence of voltage in AC and Pulsating DC Circuits and in various electrical apparatus. . . . Pocket-size illustrated above, also in Station and Overhead Extension types. Thousands in use. Order from Electrical Jobber. Send for new literature.

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MANUFACTURERS OF STATISCOPES, HANGERS, CLIPS, STRAPS, INSULATING AND CABLE-PULLING COMPOUNDS
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MOTOR PROTECTION RELAY PREVENTS MOTOR FAILURE FROM

Single-phasing; Motor Overload; Voltage Unbalance; Low Voltage;

Without Any Unnecessary Interruption of Service.

Write for Technical Data, Prices and Delivery.

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Available in Explosion Proof Enclosures

EEI Studies Capacity Plans

(*Continued from page* 63)

sociates and U.S. delegate to the International Electrotechnical Commission, told the EEI Committee that U.S. standards must be acceptable to both foreign and domestic engineers if bi-lateral benefits of international standardization are to be achieved. The U.S. concept of standards, unlike that other countries, is a "go no-go" gage against which a designer's work is measured. The result is higher cost but better quality in most instances. However, Foote noted that when it comes to oil circuit breakers Americans can profit by looking at what the British consider arc extinction criteria.

International standards for temperature rise of rotating machines are 10 degrees higher for rotors and 20 degrees higher for stators than U.S. standards, C. E. Asbury, Commonwealth Associates, said in reporting on IEC standardization development activities. Moreover IEC has lumped all temperature rise data for hydrogen and air-cooled generators in a single table in spite of vehement but futile protests by the U.S. delegation. U.S. engineers feel that separate tables of temperature rise should be established for hydrogen- and air-cooled generators.

J. B. McClure, General Electric Co described committee work in progress by U.S. task forces studying the need for impulse testing of rotating electrical machinery. Proposal that such studies be made, looking to a possible international standard, originated in Europe several years ago. Preliminary investigations of the U.S. groups suggest, however, that there is no justification for impulse acceptance tests on ac rotating machinery, McClure said.

Expansion of Duke Power Co's 230-kv system appears inevitable in any long range plan. Studies described by F. W. Beyer have pushed the planned capability beyond 4,500 Mw and shown that economic development calls for one additional high capacity centrally-located generating plant immediately after 1961. Plans call for a new hydro plant, Cowans Ford, on the Catawba between Mountain Island and Lookout Shoals, 7 miles upstream from Riverbend steam plant. This plant will have 112-ft head and an ultimate of 350-Mw; the first three units

totalling 262 Mw would be in service in 1963. Cowan's Ford reservoir would later become the cooling water source for a 1,200-Mw thermal plant, Beyer said.

Electrical features of Duke Power's new Allen steam plant designed for an ultimate of 1,200 Mw by 1961 were outlined by J. Q. Wray. Units 1 and 2, each with a capability of 175 Mw, went into operation last year. Plant cost for this initial installation was $112 per kw, Wray said, including all overheads and interest during construction, land and step up substation, and some facilities built for the ultimate plant. Design performance of initial units is 9,080 Btu per net kwhr at 2,400 psi and 1,050/1,000 F.

Charles Wasserman told the committee that Baltimore Gas & Electric will need 500,000 kvar of switched capacitors in the next 10 years. Plan is to install them near the ends of 3-phase mains of 4-kv feeders and switch them by remote carrier control to achieve voltage regulation. At present the utility operates 195 carrier receivers for capacitor switching with 11 station control points.

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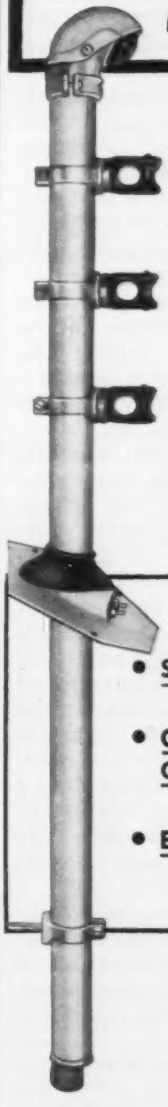

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(*Continued from page 66*)

and stations are being laid out to permit easy development at 138 or 345 kv.

Complexities of operation and equipment limitations at 138 kv were considered. The studies include estimated costs for operation and maintenance of lines and stations. The benefits of strong interconnection ties are well established and have been included in the plans.

In comparing plans through quadruple load, studies investigated inflationary trends and considered annual as well as investment costs. An allowance was made for future declining costs of 345-kv equipment after omitting inflation and considering the trend toward lower insulation levels for 345-kv transformers.

In considering future 345-kv superimposed on an existing 138-kv system, one expensive consideration is the 345/138-kv stepdown substation. Although the 345-kv line may be cheaper than three 138-kv lines, having quite large conductors, the line terminal facilities for the 345/138 kv stepdown substation add $6 to $7 per kva.

In one plan considered the system was developed, through quadrupled load, by expanding the 138-kv system. Another plan went to the opposite extreme in both costs and system change. It provided for the construction of all new facilities at 345-kv from 1959 through quadrupled load. A third plan showed the effect of breaking into 345-kv construction at approximately double load, and a fourth plan into 345-kv at triple the 1954 load.

The higher costs for 345-kv transmission indicate that the Consumers system should continue at 138 kv for the immediate future. But cost differences are expected to decline.

Though this study showed that continued operation at 138 kv will be most economical for loads up to 5,300 Mw, it appears probable that at some larger load 345-kv transmission be more economical. If 345 kv is required for a load between 5,300 and 10,600 Mw, it will be possible to determine when 345-kv construction and operation or 345-kv construction with 138-kv operation is required for maximum economic return.

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The Meetings Calendar

NOVEMBER

Atomic Industrial Forum—Annual Conference, Shoreham Hotel, Washington, D. C., Nov. 10-12.

• **Edison Electric Institute**—Accident Prevention Committee, Hotel McAlpin, New York City, Nov. 10-12; Commercial Cooking & Water Heating Committee, Pittsburgh, Pa., Nov. 13-14; Industrial Power and Heating Group, Pittsburgh, Pa., Nov. 19-21; Commercial Lighting Committee, Cleveland, Ohio, Nov. 20-21.

National Electrical Manufacturers Association—Annual Meeting, Traymore Hotel, Atlantic City, Nov. 10-14.

Southeastern Electric Exchange—Sales Committee, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 11-13.

Electric Council of New England—Annual Conference, Hotel Somerset, Boston, Mass., Nov. 13-14.

Pennsylvania Electric Association—Transmission and Distribution Committee, Mountain View Hotel, Greensburg, Pa., Nov. 13-14.

• **Canadian Electrical Assn**—Engineering Division, Western Zone, Saskatchewan Hotel, Regina, Canada, Nov. 13-14; General and Sales Division, Western Zone, Palliser Hotel, Calgary, Canada, Nov. 17-18.

National Association of Railroad and Utilities Commissioners—Annual Convention, Westward Ho Hotel, Phoenix, Ariz., Nov. 17-20.

American Standards Association — National Conference on Standards, Roosevelt Hotel, New York City, Nov. 18-20.

Pacific Coast Electrical Association—Administrative Services Conference, Hotel Claremont, Berkeley, Calif., Nov. 19-20.

American Society of Mechanical Engineers—Annual Meeting, Statler & Sheraton McAlpin Hotels, New York City, Nov. 30-Dec. 5.

DECEMBER

American Mining Congress — Annual Membership Meeting—Plaza Hotel, New York, N. Y., Dec. 1.

American Society of Refrigerating Engineers — 45th Semi-annual Meeting, Roosevelt Hotel, New Orleans, La., Dec. 1-3.

Edison Electric Institute—EEI-AGA Electronics Seminar, Commodore Hotel, New York City, Dec. 1-3; Street Lighting Committee, Hendersonville, N. C., Dec. 10-11; Industrial Relations Committee, EEI Headquarters, New York City, Dec. 4.

National Warm Air Heating and Air Conditioning Association—Annual Convention, Cleveland, Ohio, Dec. 1-4.

The American Society of Mechanical Engineers—23rd National Exposition of Power & Mechanical Engineering, New York Coliseum, NYC., Dec. 1-5.

Eastern Joint Computer Conference & Exhibit—Sponsored by American Institute of Electrical Engineers, Institute of Radio Engineers and Association for Computing Engineers, Bellevue-Stratford Hotel, Philadelphia, Pa., Dec. 3-5.

Institute of Radio Engineers—Annual Conference of the Professional Group on Vehicular Communications, Sherman Hotel, Chicago, Ill., Dec. 4-5.

Electric Companies Public Information Program—Steering Committee, Palmer House, Chicago, Ill., Dec. 8.

American Nuclear Society—Annual Meeting, Sheraton Cadillac Hotel, Detroit, Mich., Dec. 8-10.

• **Interstate Power Club**—Final Meeting, Hotel Martinique, New York City, Dec. 8.

Washington Public Utility Districts' Association—Annual Membership Meeting, New Washington Hotel, Seattle, Wash., Dec. 11-12.

JANUARY - 1959

Pennsylvania Electric Association—Communications Committee, January 22-23; System Operation Committee, Johnstown, Fort Stanwix Hotel, January 29-30.

American Society of Heating & Air-Conditioning Engineers—14th International Heating & Air-Conditioning Exposition, Convention Hall, Philadelphia, Pa., Jan. 26-29.

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